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Electrical World

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Electrical World

New York, Saturday, September 17, 1921

Saturation—in Other Industries and in Our Own

MOST of the great industries that sell direct to the home are engaged in providing almost entirely for replacement. They face a condition quite different from that encountered by the electrical industry. And when you come to think of it, the comparison is interesting.

The clothing business, for example, is one of the great basic trades. Its sales are tremendous in volume and value, yet everybody already has clothes. The furniture business is gigantic in its proportions, yet every existing home already has its beds, tables and chairs. The sales of cutlery, kitchenware, china, bedding and rugs are enormous, yet every home is already equipped. More sewing machines are made and sold today than ever before, though it was estimated forty years ago that every household was supplied. Everywhere it is the same. They sell to apparently saturated markets and still their business grows.

With us in the electrical industry, however, an entirely different situation exists. In the first place, out of the twenty-two million households in the land, we have not yet begun to reach some fourteen million, because their houses are not wired. The great business of selling electric service to the home, therefore, has so far been restricted to the eight million other families who use electric light. And out of them we know how few there are as yet who have even begun to realize what comforts and economies are offered today and to take advantage of them. We are selling to a market that is both unsaturated and unawakened. We have built up our industry to its present growing size by the hasty and partial cultivation of a mere fragment of our field.

So at present we sell this commodity of ours, which ultimately will be in universal use, to less than one-third of the people. On top of that, only a mere fraction of those who do use electricity today are using it in more than a most meager way. The great majority apply the service only to providing light. Some day they will be cooking with it, sweeping with it, washing and ironing with it, heating their homes with it and doing with it most of their work of housekeeping. But millions of these homes have not even begun to *think* about any of these things as yet.

There is no such word as saturation for us. When every factory and every store uses electricity for power and heat and light, when every household makes the most of it, then only will the electrical industry get into its stride. Our chief concern today must be to awake the sleeping millions of people who are still unconscious of the full meaning of electric service.

James Burke

An inventor, electrical engineer and executive, who through creative genius, perseverance and leadership is widely recognized as a talented contributor of engineering fundamentals essential to the development of the electrical industry from its beginning.

TO THE statement frequently made that inventors and other geniuses are poor business men the career of James Burke is an exception. During fifteen years as an electrical designer in this country and abroad, prior to establishing in 1904 the Burke Electric Company, of which he is president, his inventive ability received international recognition. The patents granted to him for the design of a generator winding by which three-wire service was made possible from a single machine and his "universal" motor that operates on both direct-current and alternating-current circuits have had far-reaching effects on the expansion of electric service. Both inventions were original in their conception and stand today as the highest types of design in their respective applications. They have also been widely adopted by prominent manufacturers under licensee arrangements. The Crocker-Wheeler Company for years has built the Burke type of three-wire generator, and it is found today in many office buildings, hotels and industrial plants. The "universal" motor has been the foundation for the wide use of portable electric tools, vacuum cleaners, electric fans and other motor-operated labor-saving devices for the home. Such is Mr. Burke's inventive genius.

His position at the head of a progressive manufacturing company during the past seventeen years and the influence he has wielded in the affairs of the electrical industry during that time, particularly in the promoting of the principles and ideals of the Electric Power Club and matters of electric standardization here and abroad, have won for him the same high standing as an executive that he has always enjoyed as an electrical engineer.

Mr. Burke was born in England April 7, 1873, and obtained his technical training under the handicap of self-instruction gained mainly by night study after working hours. The proficiency he thus acquired and his fondness for electrical experimenting obtained for him a position in the Edison Machine Works at Schenectady when he came to this country at the age of sixteen. With that company and the General Electric Company, which later absorbed it, he spent six years, going through one department after another, until he had acquired such a thorough knowledge of the process of manufacturing that he was appointed to the company's staff of designing electrical engineers. In December, 1894, Mr. Burke resigned from the partnership of Herrick & Burke, to engage in a consulting and designing practice with headquarters in New York City. While thus engaged he designed motors and generators for the Bergmann Electric Company in Berlin, Germany. The success of this work caused him to give up his consulting practice in 1898 to go to Berlin in charge of the manufacturing and engineering operations of the Bergmann Electric Company, with the title of director and chief engineer.

Six years later Mr. Burke returned to the United States and established the Burke Electric Company—in July, 1904. As president of that organization ever since he has built up a motor and generator business that has a high standing in the manufacturing industry both here and abroad. During the war Mr. Burke converted the activities of his company into production channels for the nation, manufacturing special electrical machinery the need for which sprang from the war emergency.

Mr. Burke is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers, the American Association for the Advancement of Science and local societies in Erie, Pa., where his headquarters are. He is a member of the standards committee of the A. I. E. E. and also of the United States committee of the International Electrotechnical Commission. In May, 1919, he was elected president of the Electric Power Club and served for two terms.

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Political Versus Consumer Ownership

A HAPPY antithetical phrase and one giving food for much thought and discussion is "political versus consumer ownership." It presents the real crux of municipal and governmental ownership agitations. In California particularly this phrase finds a ready application and a very direct bearing; for in that state a proposal that the state own, construct and operate electrical generating, transmission and distribution systems has recently been made. Fortunately for the general progress and prosperity of California, the electric utilities there have well-launched and successful policies of selling their securities directly to their consumers. This has been done on a very extensive scale both as regards the total value of the securities sold and the number of individual subscribers. The result is that those utilities are rapidly reaching the point where it can be said that the citizens of California already own their utilities. This robs the municipal-ownership partisans of their one talking point, that of ownership of public necessities by the public. A change to municipal possession would be one to "political ownership." The conclusion from the success of the companies' policy is obviously that the voters do not want such ownership; they prefer to own these valuable properties themselves rather than make them the appendages of politics.

Meaning of Arbitrator's Decision in Chicago Building Trades Controversy

IT IS hardly conceivable that the decision in the Chicago building trades controversy can start a big building boom at this time of the year, particularly under the country-wide conditions that exist. Its importance and the reason for the widespread effect that it will have on the building industry, and indirectly on nearly every other industry, are due to the crystallization of public sentiment that it will bring. All through the investigations the pot and kettle called each other black until the bewildered public, though convinced that neither was of alabaster, found it impossible to tell which had the darker hue. Judge Landis has pointed in a very definite way to certain practices that are vicious, and in some cases where the guilty have refused to reform he has not hesitated to name them and describe their practices. Middle Western people who know the judge have confidence in his honesty and fair-mindedness, particularly because of the fear he inspires among the criminal element. While they may not always agree with him, they know he has the courage of his convictions and is not swayed by prejudice. His findings will be accepted generally as a measuring stick by which to judge the whole situation. It will be difficult for any one to oppose his findings, particularly as the men most anxious to oppose them will be those tainted in the public mind by questionable if not actually criminal practices. It will be hard, also, for those who have held aloof in the proceedings to stand against the public sentiment that will rally in support of the decision, since they also have been under the suspicion of wanting to maintain the very practices that the arbiter has ruled against.

While the wage scales established are important, they are, after all, a minor factor because with changing conditions it is hardly likely that they will be of long standing. With public backing the effort to eliminate the questionable practices in the building trades that have existed in Chicago as well as in numerous other sections of the country will have a wide effect, not only on the building trades, but also on every line of industrial endeavor. It will make for a higher moral plane in all business activities.

Hydro-Electric Development of the Colorado River

THE hydro-electric development of the Colorado River has given rise to much controversy. Uncontrolled, the river is a peril to lives and property in the Imperial Valley in California and the low-lying adjacent lands in the United States and Mexico which are below sea level. Completely controlled, the Colorado River can be used to irrigate about two million acres of land and make available approximately 5,000,000 potential horsepower. Any development of the river, however, must be made first with a view to flood control; second, to serve irrigation requirements, and, third, for power purposes. To meet the first two requirements a huge storage reservoir to hold the total normal flow of the river for from two to three years would have to be erected. A dam 500 feet high thrown across the Colorado at Glen Canyon, "at the top of the hill," would provide a uniform stream flow throughout the year that would be available for whatever power plants may be built between Glen Canyon and sea level, besides yielding ample water to irrigate all irrigable land. A second possible reservoir site is at Boulder Canyon near the "foot of the hill." There a dam 600 feet high would form a storage lake ample for complete regulation. Either dam would solve the flood control and irrigation problem completely, but that at the Boulder Canyon would not provide regulation for power purposes except for plants built below that site, nor would it permit of a comprehensive development of the river as a whole.

Obviously, it would not be economical to build two huge dams each 500 feet to 600 feet high if one will do. The question is of such vital importance because of the

immense irrigation and power possibilities involved that nothing short of a comprehensive plan for the best final development of the river should be adopted. The Federal Power Commission now has the matter under advisement and can be counted on to conserve the interests of the country as a whole, and particularly the interests of the states of Arizona, Nevada and California, in working out a plan to which every licensee on the river must conform.

Model State and National Conventions

THE convention of the Pennsylvania Electric Association held last week differed from the convention of the Association of Edison Illuminating Companies held this week in that at the former those in attendance comprised superintendents, operators and heads of departments who have their hands on the throttle and are actively engaged in every-day operating problems. The Edison conventions, on the other hand, are attended chiefly by the executives of the largest urban companies in the country. Naturally the conventions differ widely in the character and scope of the papers presented, since one is held by a state and the other by a national body. However, each is typical and forms an excellent pattern for convention work. The intimate contact and exchange of experiences between operators is one of the chief assets of the Pennsylvania convention and emphasizes the desirability of strong state associations as a foundation for the electric light and power industry. The greater and broader problems naturally fall to the national body, made up as it were of men who are post-graduates in the business and are therefore equipped to handle these problems in a large way. This makes for thoroughness and order and enables the industry to move forward rapidly, confident in the mastery of its affairs arising from the accumulated experience, counsel and skill of all its members, as exemplified in state conventions, with the national body eventually acting as a clearing house for the benefit of all.

Are the Users of Trucks Getting Full Benefit from Them?

LACK of specific cost information on the performance of industrial trucks, even in installations handling large tonnages, is rather startling to the investigator. In too many instances the only information available concerns the general groups of wages, cost of repairs and battery maintenance and cost of energy to charge the batteries. The only comparative information is that the total cost is less than the cost of the older methods and to that extent there is a saving of money. The cost of operation on a weight-distance basis is a missing figure in most cases because no reliable figures on the tonnage and the distance traveled are available and there is little attempt being made by the user to make them available.

The modern factory devoted to quantity production is keenly interested in eliminating unnecessary movements of material, and it has come to be a common saying that the raw materials go in at one end and the finished product is loaded onto the cars at the other. Great pains are taken to see that the material is always kept moving in the same direction and that no unnecessary distance is traveled. These results are accomplished after careful studies in which not only the financial but also all physical factors are carefully ascertained and the physical factors reduced to a financial form of statement. The maximum benefit of truck service in any plant can be obtained only after all the data necessary to an analysis of what is being done are gathered and the lessons taught by the analysis put into practice. A unit weight carried over a unit of distance costs money, and unless figures are available showing the weights carried and the distance traveled it is impossible to determine whether the weight-distance factor has been reduced to the lowest practicable limit.

The argument that it is impossible to change factory arrangements on the saving that might possibly be shown is weak since because of the changing conditions in factory processes the active factory is forced from time to time to remodel its arrangements. Accurate information on the handling costs of materials and completed products is necessary if these changes are to be intelligently planned.

A New Electron Tube—the Magnetron

THE most conspicuous and probably the most important new electrical device of the past decade is the hot-cathode vacuum tube. Its astonishingly rapid application in the radio telephone and telegraph fields is well known. Recognized first as an interesting but unimportant phenomenon in the incandescent lamp, the electric discharge from hot bodies was neglected through a number of years until the remarkable properties of electrons, uncovered by the physicists, drew attention to the possibilities of useful application. Then followed rapidly the development of rectifying valves, detectors, X-ray tubes, amplifiers and oscillating generators, resulting in a period of unprecedented expansion and development in the fields mentioned. And the end is not yet.

Now comes the announcement of another addition to this already indispensable tube family, namely, the "magnetron." This was the subject of a lecture by A. W. Hull at the annual meeting of the American Institute of Electrical Engineers, and the first printed description appears in the September number of the *Journal* of the Institute. The tube has the usual hot cathode and plate anode and in its conductivity obeys the well-known laws involving the plate potential and filament temperature. The salient feature lies in the control of the current through the tube by a magnetic field. The tube is cylindrical in shape, and filament and plate must be symmetrical about the axis of the cylinder. The controlling magnetic field is furnished by an external coil with axis coincident with the axis of the cylindrical tube. Up to a critical value of the current in this external magnetizing coil the tube has full conductivity, but beyond this critical value it ceases completely. It is at once obvious that in this way all of the normal phenomena of the three-electrode tube can be accomplished in the magnetron by means of current in an external coil rather than by means of current in a grid inside the tube. The separation of the control and tube circuits will be seen as an important feature.

The explanation of the operation of this tube lies in the deflection of the path of a moving electron when passing in a magnetic field. Above a certain strength of field, electrons leaving the central filament are turned

back without reaching the outer plate electrode. This deflection of electrons in a magnetic field is an old phenomenon which has been identified with the entire development of our knowledge of the property and behavior of electrons. It was used by J. J. Thompson in the original studies of the values of the charge and mass of the electron, and by Becquerel in studying the velocity of the ions emitted by radium. It is also an essential part of the principle of the cathode-ray oscillograph. A moving charge is the equivalent of an electric current and consequently suffers mechanical force and change of direction when moving in a magnetic field.

Perhaps the most striking feature of the paper mentioned is the concluding paragraph containing predictions of the author as to the future possibilities of tubes of this type. In his mind they will soon be used as rectifiers for series arc lighting and for replacing synchronous converters in substations, and, looking still further, he finds them on electric locomotives, permitting the use of direct-current motors and finally direct-current transmission lines fed through transformers and vacuum-tube rectifiers. It is to be hoped that he speaks with the voice of authority and of knowledge of facts already accomplished but still unannounced. It will indeed be a continuation of the remarkable achievements of the early years of these phenomenal little tubes if the predictions mentioned are only partly realized.

Insulator Development on a Rational Basis

IN THE operation of extra-high-voltage lines the flashing over of the insulator strings is one of the most serious troubles that are encountered. Lines as low as 60,000 volts are subject to such disturbances, but in these cases the flashovers are due in the main to high-voltage transients of a value greater than the rupturing voltage of the normal gaps between the conductors and ground. In the higher voltages—namely, 150,000 volts and more—the flashovers are due to more complex causes as outlined in the paper in this issue by Harris J. Ryan, H. H. Henline and F. F. Evenson. Only within very recent years has the subject of insulation of these lines been approached on a rational basis. The mere piling up of more and more insulators in the hope of so increasing the air gap that neither the line voltage nor the transients usually encountered could jump over the gap has proved inadequate for voltages of this range. The studies reported in the paper just referred to were not undertaken to prevent the occurrence of flashes over the insulators but to restrict them and, when they do occur, direct their course so that the arcs will not shatter the porcelain.

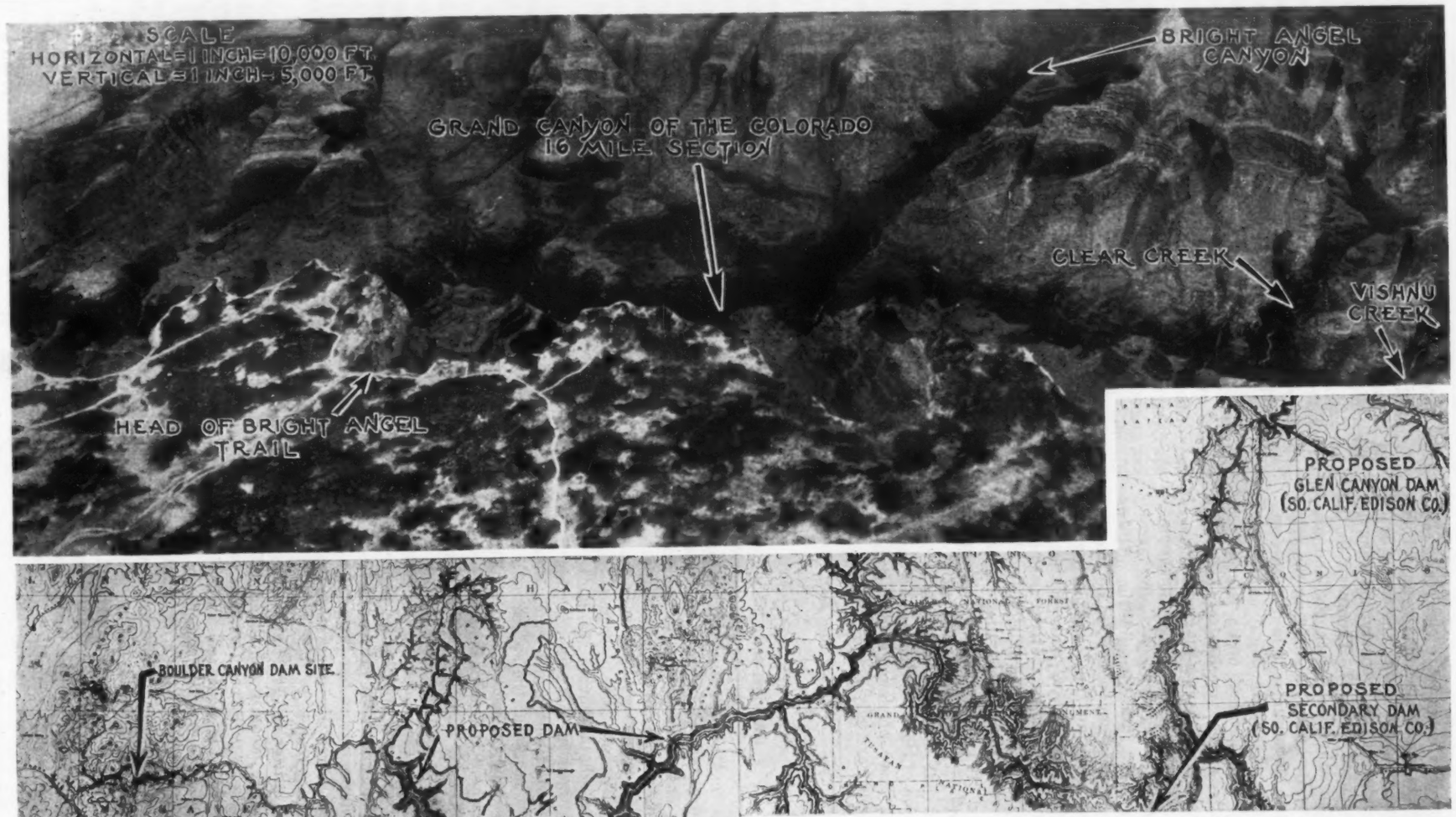
Even now these and other similar studies have had practical application. The recently completed 165,000-volt line of the Great Western Power Company, which stretches across California, is equipped with shields placed between the line conductors and the lower units of the insulator strings. The shields so distribute the unit duty on the strings that the line-end units are at less stress than is usually encountered in lines of lower voltage. Although this line has not been operated long enough to get conclusive proof of the effectiveness of these shields in preventing and directing flashovers, yet the tests indicate that the line should be little endangered by this form of trouble. A further application of the theories so far developed is to be made soon on the 220,000-volt lines of other California companies.

How Shall the Student Engineer Be Taught?

WHAT training shall the engineer receive in his college or university course? The tendency in the past has been toward ultra-specialization in the purely mathematical, scientific and technical phases of the course in which the particular student is interested. This tendency has produced some engineers to whom the fact that certain things are justified from an engineering viewpoint is sufficient to justify their application in any and all situations without the consideration of any other factors. The result has been the erection of many structures that are perfect from a purely theoretical engineering viewpoint but a reproach to the engineering profession from other viewpoints. Engineering is fundamentally a means or method through which it is possible to accomplish certain results. The results must be justified by the benefits that accrue to the community. These benefits may be and usually are measured in financial terms, though there are matters concerning public welfare and health in which the question of direct profit or loss is a minor or non-existent consideration.

The engineer must therefore be capable of deciding whether the course he recommends is justified not only from an engineering viewpoint but also from a broader viewpoint that is primarily economic. The effort of the engineering schools should be directed more and more to giving the young engineer an education well balanced between engineering fundamentals and the economic considerations that govern the world in which he must work. Some clear-thinking engineers are even raising the question whether an engineering course should not begin with a year or preferably two years of a collegiate business course framed so that the student's mind would be actually taken entirely away from engineering subjects and concentrated on preparation for a business career. Economics, political economy, English and studies dealing with the every-day problems in the business world would predominate, and, in preparation for the engineering studies to come later, intensive study in mathematics would be carried on. The last years of the course would then be devoted to intensive work on engineering subjects with their relation to the business studies of the earlier years constantly emphasized. Through the entire course the largest possible amount of practical work during the school term and the summer season should be undertaken in order to teach the student the practical application of the principles he is learning and above all give him the attitude of mind with which he must face the problems of his business career. The whole effort would be directed toward impressing the student with the idea that technical theory is an important guide, but cannot be made the supreme arbiter inasmuch as no one theory can comprehend all the factors on which a single decision must be based.

The problem is essentially one of sending out students who can approach their work with an attitude of mind related to that of the seasoned executive. While it is not possible in a school course to give the student what the business man has learned only in a long period of years, it is possible to send him into the business world with an attitude that will not have to be overcome and the individual's whole habit of thought reversed as the result of hard knocks and bitter experience in the post-collegiate environment.



Proposed Hydro-Electric Development in the Grand Canyon of the Colorado

THERE are two principal applicants for the hydro-electric development of the Grand Canyon of the Colorado. The Southern California Edison Company proposes to construct a 500-ft. dam at Glen Canyon just above the mouth of Paria River, which would provide a storage of 40,000,000 acre-feet and a uniform flow throughout the year. Additional low-head dams are part of this project. The scheme of development on which Los Angeles has filed proposes a 600-ft. dam in Boulder Canyon, just below the mouth of Virgin River. A complete development from Glen Canyon to the "foot of the hill" would yield about 4,000,000 hp. at a total cost about on the order of that of two Panama Canals.

The cut is a photograph of a bas relief of the Grand Canyon of the Colorado constructed by the American Museum of Natural History and topographic maps issued by the United States Geological Survey.

Capital Needs and Sources of Availability Should Be Predetermined

Failure to Estimate Them in Advance May Embarrass Companies at Critical Periods—Higher Business Efficiency Can Be Assured by Maintaining Simple Budget System — Application of Such a Plan to Public Utilities Considered

By R. S. SEESE
Electrical Engineer, Chicago, Ill.

ALTHOUGH it would be thought suicidal for the head of any enterprise not to make in advance some provision for financing its operations, it is surprising how many organizations do not employ a really systematic plan for predetermining the amount of capital that will be needed, where such capital will be procured and how and when it will be expended. The lack of ready cash often prevents the purchase of badly needed equipment or of materials at large-quantity prices, thus forcing the operation of the business at a lowered efficiency. On the other hand, the purchase of such things at haphazard, without careful provision for payment, frequently causes an embarrassing situation requiring drastic action at a sacrifice to some phase of the business.

Nor is this lack of advance preparation in financing common to the smaller companies alone. Commercial history cites numerous cases in which companies doing millions of dollars' worth of business annually, at rates carrying a satisfactory profit, became seriously embarrassed and not infrequently went into receivership because they were unable to obtain money at the moment it was needed. Even in normal times, seasonal fluctuations in the demand for various commodities cause a wide variation in the amount of capital required to operate a business. In times like the present, when there is added the uncertainty of obtaining any outside capital at all, the necessity for careful planning far ahead is increased manyfold.

Financial experts tell us that most business failures are due primarily to lack of adequate working capital. This dictum might be amended by saying that the lack of capital occurred at the time when it was most needed. In other words, the average working capital carried by the company was sufficient, but the operators failed to provide a maximum of capital when the expenditures reached a peak.

Some companies carry an excess of working capital in order to "play safe," but this is as great an error as carrying too little. Public utilities, fortunately, may carry their working capital at a minimum, because their receipts and expenditures can be accurately calculated in advance and their business is not ordinarily subject to the rapid fluctuations that occur, say, in manufacturing or jobbing.

A public utility may depend on its monthly receipts to pay current operating expenses, but should establish a reserve for the periodic payment of interest and other fixed charges and of seasonal repairs and maintenance work. An advance estimate for a utility company, setting forth expected receipts and expenditures over a long period, can be accurately made, even including expenditures for new construction, no matter whether the construction expense is to be paid out of new capital procured by the sale of securities or partly out of current earnings. Such an advance estimate, or budget, if calculated by small increments of time over a considerable period, is an invaluable aid in financing.

The budget must not be confused with an operating statement nor with an advance operating statement, because it has no direct connection with "sales" and "expenses." If properly constructed, the budget shows how much money will be spent for all purposes during the period and indicates the source of this money; that is, whether it is obtained from earnings or from outside the business. As the amount of cash available at certain times of the year may be insufficient to meet the expenditures at those times, the budget indicates when money must be borrowed and the times when it will be most convenient to repay it.

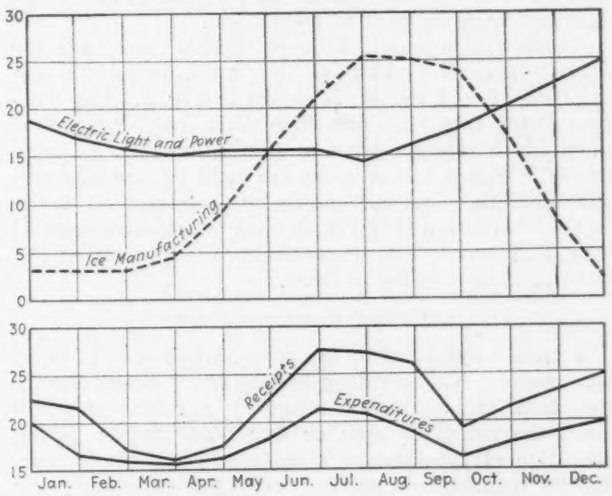


FIG. 1—RECEIPTS AND EXPENDITURES OF ICE-ELECTRIC PROPERTY PLOTTED TO SHOW METHOD OF ANALYZING FINANCIAL NEEDS

Probably the most popular form of budget covers operations by the month for the period of one year. Fig. 2 shows a simple form of such a budget. Assuming that dividends, accrued interest and so forth for the preceding year are paid, the cash balance for the beginning of the current year is relatively small. The receipts from all sources and the expenditures necessary for the conduct of the business are carefully estimated. Setting these down by the month, the cash balance for each month is then rapidly calculated, thus determining the times, if any, when it will be necessary to obtain outside capital to carry out the year's program. If, after this schedule is completed, it is apparent that

Line	Item	Date	Jan.	Feb.	Mar.	Apr.
1	Cash balance	1/1	2 500 00	3 500 00	3 500 00	1 000 00
2	Notes Ref. A		--- --	--- --	1 000 00	--- --
3						
4	Oper. Receipts		10 000 00	9 000 00	8 700 00	8 700 00
5	Total Rec.		12 500 00	12 500 00	13 200 00	9 700 00
6						
7						
8						
9						
10	Power House		6 500 00	6 500 00	6 200 00	6 200 00
11	Line Dept.		550 00	550 00	450 00	450 00
12	Office		750 00	750 00	650 00	650 00
13	Supplies		600 00	600 00	550 00	550 00
14	Salaries		600 00	600 00	600 00	600 00
15						
16	Preferred Div.		--- --	--- --	1 500 00	--- --
17	Int. on bonds		--- --	--- --	2 250 00	--- --
18	Notes pd.Ref A		--- --	--- --	--- --	500 00
19	Common Div.		--- --	--- --	--- --	--- --
20						
21						
22	Total Distur.		9 000 00	9 000 00	12 200 00	8 950 00
26v	Cash balance	1/31	3 500 00	3 500 00	1 000 00	750 00
Ref.	"A" Demand notes.					

FIG. 2—A TYPICAL BUDGET FORM

Budget 1921 (3rd quarter)		July			August	
Line	Item	1 to 10	11 to 20	21 to 31	1 to 10	11 to 15
1	Cash bal.	4 500 00	6 615 00	9 655 00	12 285 00	15 325 00
2	Borrow					
	RECEIPTS					
3	District #1	10 000 00			10 400 00	
4	District #2		9 000 00			9 250 00
5	District #3			12 600 00		
6	Appliances	350 00	250 00	240 00	240 00	240 00
7	Other sources					
8						
9	Total Rec.	14 850 00	15 865 00	22 495 00	23 925 00	24 815 00
	DISBURSEM'TS (Power House)					
10	Labor		750 00	750 00		750 00
11	Coal	3 000 00	3 000 00	3 000 00	3 000 00	3 000 00
12	Supplies	100 00	100 00	100 00	100 00	100 00
13	All other (Line Dept.)	350 00	350 00	350 00	350 00	350 00
14	Labor	775 00			775 00	
15	Supplies	65 00	65 00	65 00	65 00	65 00
16	(Office)	760 00	760 00	760 00	760 00	760 00
17	(New business)	285 00	285 00	285 00	285 00	285 00
18	Salaries	900 00	900 00	900 00	900 00	900 00
19	Fixed charges	--- --	--- --	--- --	--- --	--- --
20	Notes pd(L.2)	2 000 00	--- --	3 000 00	--- --	3 000 00
21	Appliances	--- --	--- --	--- --	2 365 00	--- --
24	Total Distur.	8 235 00	6 210 00	9 210 00	8 600 00	9 210 00
25	Cash Balance	6 615 00	9 655 00	13 285 00	15 325 00	15 605 00
				(Fixed chgs. due Sept. 30 $28,600)		

FIG. 3—BUDGET FOR EACH TEN DAYS

there will be a deficit of ready cash at some time during the year, it is often possible to shift certain proposed expenditures or to defer them until the budget indicates sufficient cash on hand to meet them.

Another form, in which the calculations are made for ten-day periods ending on the tenth, twentieth and thirtieth of each month, is shown in Fig. 3. The company using this form has three distribution properties from which receipts come in at different times of the month. Wages and salaries are paid on the fifteenth and thirtieth. Coal and supply invoices are paid on the tenth, twentieth and thirtieth, thus taking advantage of cash discounts and at the same time concentrating the work in three ten-day sections.

SIMPLEST FORM THE BEST

A budget must not be too complicated, if it is to be serviceable. No operating official can foresee exactly the conditions which will affect the purchase of materials, the price of labor or any other factor in the operation of the company's business for a whole year. Twelve months is a short time when calculating the earning capacity of a property, but it is a whole life-time when considering what may happen to machinery and equipment, or what difficulties may arise with labor or the public which will boost operating costs or cut down revenue. It is therefore unnecessary to subdivide the various items of the budget sheet minutely, although this may be done on separate sheets when making up the budget, and indeed is quite necessary when computing any item whose amount is in doubt or which is subject to undue variation. As an example of this subdivision of budget sheet items, consider line 6 of Fig. 3, showing the estimated receipts from the sale of electric appliances. Fig. 4 shows the sub-estimate sheet made up by the department manager, in which he gives his calculations of expected receipts from this source and indicates the time and amount of expenditures necessary to keep up his stock. The total receipts for each month or part of month are then set down on the budget sheet, and the purchasing department is enabled to determine the best time for purchasing the appliances, thus giving the information for line 14 of the budget.

In the same manner the estimate (Fig. 5) of power-house expense is condensed and entered on the

Appliance Sales Dept. Estimate for July, 1921.						
Item	No.	1st to 10th	No.	11th-20th	No.	20th-30th
Irons	50	350 00	50	350 00	50	350 00
Ranges	2	220 00	2	220 00	2	220 00
Fans	10	160 00	10	160 00	10	160 00
Washing machine	1	150 00	1	150 00	1	150 00
all other		228 00		228 00		228 00
Total sales		1 108 00		1 108 00		1 108 00
Sales for cash		50 00		40 00		40 00
Installmt sales		1 058 00		1 068 00		1 068 00
Receipts						
From cash sales		50 00		40 00		40 00
Installments		300 00		210 00		200 00
Total receipts)budget L. 6)		350 00		250 00		240 00
Stock required	Advance requisition 256-D order July 15			2 365 00		

Power House Estimate for July, 1921.						
Item	Quan	1st-10th	Quan	11th-20th	Quan	21st-31th
Ch. Engr. 325				162.50		162.50
Asst. 160				80.00		80.00
Watch engr 100 (2)				100.00		100.00
All other (5)				407.50		407.50
LABOR ----------	total			750.00		750.00
Coal	1000	3 000 00	1000	3 000 00	1000	3 000 00
Supplies (same mo.1920 less 20%)		100 00		100 00		100 00
Maintenance						
regular		100 00		100 00		100 00
special		--- --		--- --		--- --
shop		250 00		250 00		250 00
Summary Labor		--- --		750 00		750 00
Coal		3 000 00		3 000 00		3 000 00
Supplies		100 00		100 00		100 00
All other		350 00		350 00		350 00
(Budget lines 10 to 13.)						

FIGS. 4 AND 5—DEPARTMENTAL SUB-ESTIMATES

budget sheet, lines 9 to 13. All of this departmental data must, however, be thoroughly "boiled down" in order that it may be of real value to the financial officer.

It is important to repeat that the budget is concerned with receipts and disbursements and not with sales and expenses. To any one not used to looking at the matter in this way the following examples will be of assistance: The appliance sales department, we will say, puts on a fan campaign in May and June, allowing the company's patrons to purchase fans on the installment plan. Therefore, while the sales during these two months are very heavy, the receipts derived from the first and second installments are comparatively light. Again, the company agrees to install a suburban line and transformer station to serve a group of farmers. The cost of this extension is to be paid originally by these new customers, but it is agreed that a certain amount shall be deducted monthly from the light and power bills of these customers until the company shall finally have absorbed the cost of this extension. If

Budget 1921 — 1-15 January — 16 Ja

Line	Ref.	Item	Date	Estimated	Date	Actual	Dat
1	DCB	Cash bal	1/1	7 500 00	1/1	7 500 00	1/1
2	DCB	Borrow		- --- --	1/13	3 000 00	
3	ER	Receipts					
		Light		8 000 00		8250 00	
		Power		14 200 00		13 600 00	
		Heat		6 500 00		6 345 00	
		St.Rwy		9 200 00		10 100 00	
4	DCB	Bond sales		10 500 00		9 000 00	
5	DCB	Total		55 900 00		56795 00	
6	ER/P	Expendit.					
		Power House		9 000 00		9 250 00	
		Line Depts		2 000 00		2 600 75	
		Office		2 500 00		2240 00	
		Rwy Dept		3 200 00		3 000 00	
7	DCB	Pref. Div.	1/15	18 600 00	1/15	18 600 00	
8	AK	Fd on constr	1/15	20 000 00	1/15	20 000 00	
9	DCB	Total		55 300 00		55690 00	
10	DCB	Cash bal		600 00		1106 00	

FIG. 6—SPECIAL BUDGET FORM

the transaction is a large one, the receipts from this extension will be small for a long time, yet the "sales" each month may be most gratifying. If the financial head of the company makes the mistake, as he sometimes does, of confusing "sales" with the actual inflow of good hard cash with which he must pay bills, his calculations will frequently go badly astray.

Contingencies will, of course, arise which were impossible to foresee. An attempt to take into account everything that might happen in the course of a year in a busy utility property would so complicate the budget sheet that it would be worse than useless. A "contingency allowance" may, however, be carried on the sheet, its amount based on the experience of former years, although the amount set aside for contingencies is preferably distributed over the items which are known to be susceptible to greatest variation. The budget is bound to be more or less in error in any case and will be revised from time to time, but to sum up the experience of a successful telephone executive, whose suggestions form the basis of this article, it is much better to spend a great deal of time formulating a budget and miss one's calculations than never to have attempted a budget at all.

FORM OF BUDGETS

Ruled sheets for budget work ordinarily carry no wording, as the form will require changing from time to time, and suitable wording can be readily inserted on the few copies that are required. The unworded forms can also be used in making up the departmental subestimates. If some extraordinary occurrence should sensibly change conditions during the progress of the period, a supplementary or revised budget is made, either by interlining with red ink on the original sheet or by typing a new sheet outright. It is convenient to have the entire year's estimate on one sheet, but as this is cumbersome, especially where ten-day intervals are calculated, three to six months to the sheet is the rule, and such sheets will fit an ordinary typewriter.

The writer recently saw an interesting variation of the budget form in which fifteen-day intervals were calculated and parallel columns provided in which the actual results were set down beside the anticipated ones (Fig. 6). It is usually sufficient, however, and productive of best results to make these notations in pencil or red ink on the regular budget form.

It is obviously impossible to go into great detail in this article regarding all of the various items which help to make a serviceable budget sheet. As in accounting, no two systems are exactly alike, and the purpose of these suggestions is merely to give an idea of the principle of the budget. Various modifications will occur to the user of the budget which will help him in his own particular application of the principle. No matter what form is used, the budget sheet may be considered to have performed its function if it indicates the time and amount of the major items of expenditure, if it provides sufficient cash to meet these expenditures, and if it points out the reasons for any material differences from the advance estimate.

Hydro-Electric Energy as Byproduct from Boston Water Supply

NEARLY 16,000,000 kw.-hr. was delivered in 1920 to the interconnected systems of the Edison Electric Illuminating Company of Boston and the New England Power Company by the Wachusett and Sudbury hydro-electric plants of the Metropolitan District Commission as a byproduct of the Boston water supply. The Wachusett station, situated at Clinton, Mass., receives water from the Wachusett reservoir under a head of 96 ft. and after passing it through four 1,000-kva. waterwheels discharges it into a tunnel feeding the metropolitan area. Similarly, the Sudbury station, operating under a head of 65 ft., with a plant rating of 1,450 kva. in vertical units, discharges water into the Boston supply. The latter plant was formerly a gatehouse. Last year the Wachusett station delivered 7,474,485 kw.-hr. to the two companies at 5.3 mills per kilowatthour, and from Sudbury the Edison company took 6,382,831 kw.-hr. at 6.25 mills. The Boston Edison-New England Power 66,000-volt tie line enables the plants to be interconnected when desirable and has resulted in a much larger sale of energy to these utilities than would otherwise have taken place. In eight years $500,000 worth of byproduct energy has been sold from the Boston water supply to these utilities and for pumping.

Leland Stanford Tests Indicate Nature of Breakdown

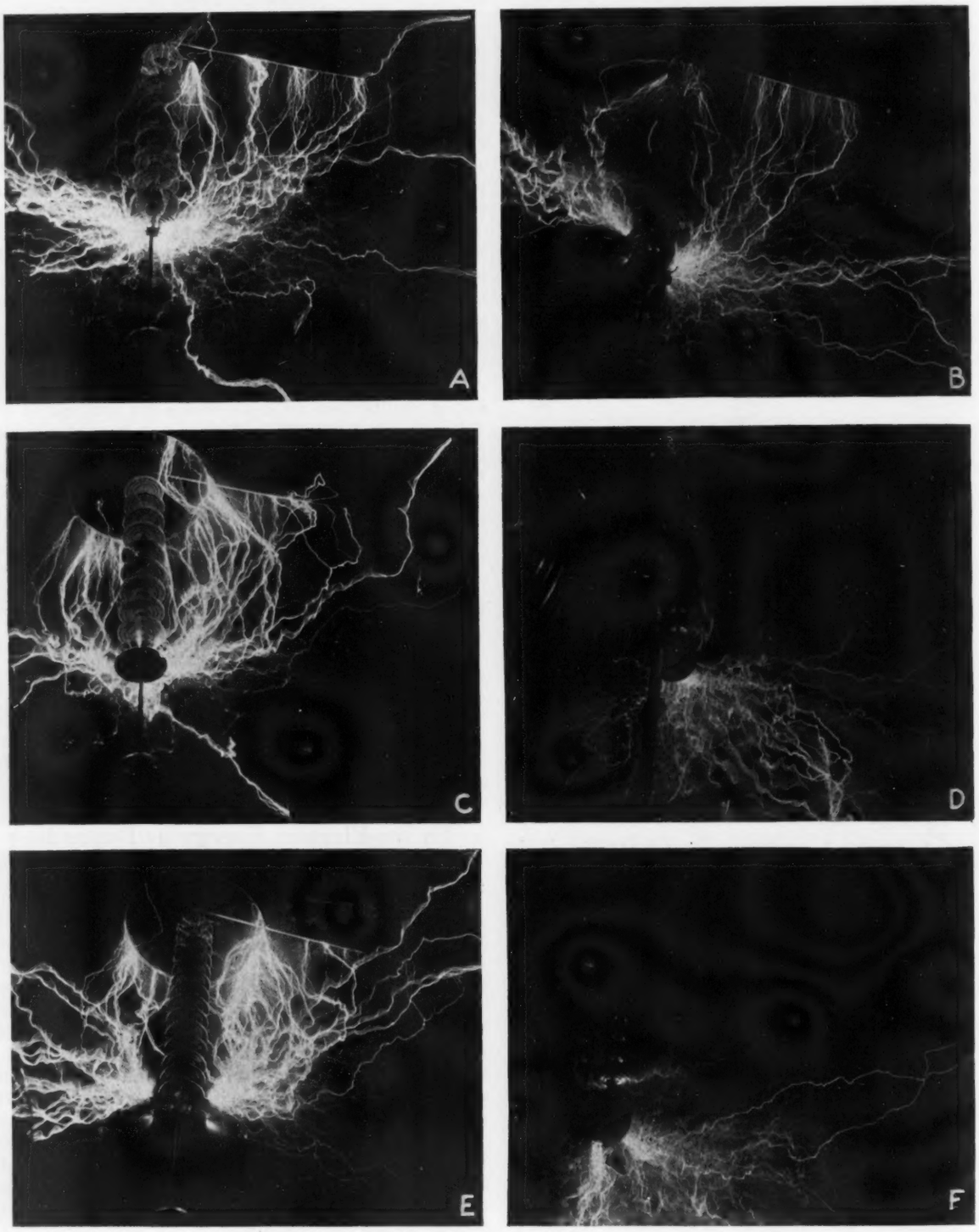


FIG. 1—JUST A FEW OF THE PHENOMENA OBSERVED IN FLASHOVERS

A—With ten-unit strings cascading is not so serious as with two, three and four-unit strings.

B—Tests in the presence of rain showed three cascades occurring, along with thirteen flashes and nineteen flashovers.

C—Thirty-one wave trains produced one weak cascade, five flashes and twenty-five flashovers. One flash to the upper right was more than double the length of the string.

D—Use of a sphere at the lower end causes the discharges to be deflected downward and outward.

E—Same as B, but without rain. Only one light cascade resulted in this case; there were nine flashes and twenty-one flashovers.

F—Same as D, with the addition of rain, which does not materially affect the result.

Flashover of Insulators for 220-Kv. Lines*

Flashover Characteristics of Suspension Insulators, Including V-Strings and Composite Strings with Shielding Devices—Investigations Indicate that Flashing May Be Controlled to Cause Minimum Destruction of Insulators

By Prof. H. J. RYAN, H. H. HENLINE and F. F. EVENSON
Stanford University, Palo Alto, Cal.

THREE sorts of electrical failures may occur in high-voltage transmission-line insulators: First, failure by puncture of the porcelain; second, failure by excessive conduction over the surface of the porcelain due to conducting material thereon, and third, failure of the atmosphere immediately adjacent to the insulator. The first type of failure has been largely eliminated by design and care in manufacture, and the second type partly by design but chiefly by better maintenance. The third type is complex, having many factors which may be grouped as follows: (1) The physical condition of the air and the presence of ions; (2) the form of the electric field in the air; (3) the magnitude and time variation of the voltage causing failure.

The first group involves the conductivity of gases.† This paper appertains particularly to the latter two divisions, and many flashovers of long insulators were made to determine the fundamentals and the relation of structural features to flashovers.

The study indicates that transient radio-frequency high-voltage discharges follow the direction of the field in which they are developed and that they can be controlled by proper attention to the forms of electrodes and the fields resulting. In the case of 60-cycle streamers a strong auxiliary field is formed, and great care must be exercised to prevent such arcs from breaking into the insulator string. Inspection of the 150-kv. Big Creek lines shows that arcs followed the initial electric fields quite generally. The simplest flashovers, those over various kinds of units in strings of two, were all by cascading, notwithstanding the fact that such strings have the best distribution of voltage. These flashovers were produced by both 60-cycle and high-frequency voltages. In all the other tests given here the latter was used, being produced by an oscillator operating at 55,000 cycles. Flashover of a string with ten units is shown in Fig. 1A. The string was set up with the high-voltage conductor connected axially and without arcing horns or shields, thus producing the highest ratio of maximum to average unit duty. Cascading is a small factor in this long string and is not due to irregular distribution of the string.

Succeeding tests were made on a ten-unit string having a 12-in. (30.4-cm.) shield at the conductor end and a 36-in. (90-cm.) shield at the tower end, shown in Fig. 1C; a fourteen-unit string with a line clamp and arcing horn at the conductor end and the 36-in. (90-cm.) shield at the tower end, shown in Fig. 1E without rain and Fig. 1B with rain; a fourteen-unit string having a 10-in. (25-cm.) sphere at the line end and no shield at the upper end, shown in Fig. 1D without rain and Fig. 1F with rain.

From this series it was found that transient radio-frequency oscillating high-voltage discharges follow the direction of the field in which they are developed and that they can be directed as desired by proper attention to the forms of the electrodes and of the field resulting. The insulators and shields shown in Fig. 5A were given thirty-two wave-train discharges, as shown in Fig. 5B, which produced two cascades of the three tower-end units on each string of the two; two 84-in. (213-cm.) discharges to the wall; three 49-in. (130-cm.) discharges horizontally to the tower, and twenty-three discharges 51 in. (135-cm.) vertically to the tower and clear of the insulators. These and other discharges are analyzed below.

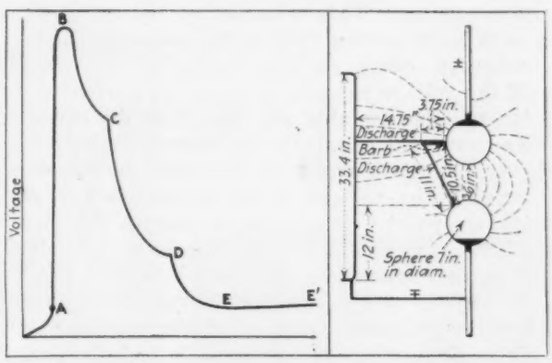


FIG. 2—PROGRESS OF CONDUCTION THROUGH A GAS. FIG. 3—OPTIONAL PATHS TAKEN BY DISCHARGES DEPEND UPON SHAPE AND DIRECTION OF INITIAL AND AUXILIARY FIELDS

FUNDAMENTALS CONTROLLING HIGH-VOLTAGE FLASHOVERS

When an electric field is set up in the air at sea level at common temperatures the air is overstressed if the gradient exceeds 76,000 volts, maximum, per inch (30,000 volts per cm.); the atoms are mutilated and therefore ionized. This is the start of a breakdown which develops into a flashover.

Insulation is either the absence of ions or it is a solid barrier to the passage of ions. Gases cannot act as barriers to stop the migration of ions formed and driven by an electric field. The insulating character of the air is therefore a negative quality; it is the absence of ions. Without ions there can be no conduction regardless of the voltage and of the field formed by the voltage. The continuity of discharges produced through a gas column is shown in Fig. 2.‡ The curve *OABC-*

*Condensed from a paper delivered before the San Francisco Section of the American Institute of Electrical Engineers.

†"Conduction of Electricity Through Gases," by J. J. Thompson; "Electricity in Gases," by J. S. Townsend; "Thermionic Vacuum Tube," by H. J. van der Bijl.

‡"Unstable States in Arc and Glow," by W. G. Cady, *Metallurgical and Chemical Engineering*, Nov. 15, 1915.

DEE', with co-ordinates *E* and *I*, expresses the continuous voltage-current relation in conduction through a gas from the saturation current at *A* to the arc at *E*. In this chart ever-changing scales are used for the values of *E* and *I*. The smallest currents are in fractions of microamperes and the corresponding voltages in kilovolts. Larger currents are plotted in values increasing to amperes and the voltages in kilovolts and volts.

GROWTH OF CURRENT THROUGH GASES

When voltage is applied to the gas between parallel plates and increased in value from zero an extremely small current is set up owing to the mobilization of antecedent ions which are the result of some obscure cause. At a few hundred volts more or less all free ions are being gathered in to form the current stream and the point *A* is reached. This ionic stream is called the saturation current. It cannot be increased by considerable increase in voltage.

By greatly increasing the voltage the current increases to the point B. Then a glow discharge appears, accompanied by a sharp decrease in voltage with increase in current. This is caused by the establishment of a sufficiently strong field in the gas adjacent to the electrodes to cause copious ionization by collision. Should the voltage remain constant, the current-voltage relation will be unstable and the glow discharge will quickly grow and culminate in general ionization and flashover. If the current is increased but controlled by lowering the voltage so as to maintain a stable relation, the point *C* is reached, whereat a third source of ionization appears. This is due to a radiation of negative thermions from the heated cathode. A further increase in current and drop in voltage then occurs, forming the half-arc. On continuation the point *D* is quickly reached, where the anode boils and gives off the greatest number of ions encountered in conduction through a gas. After passing through *D* the relation stabilizes and small increases in voltage correspond to large increases in current. The four distinct forms of discharge are summarized in Table I.

TABLE I—DISCHARGE THROUGH GASES IN RELATION TO THE SOURCE OF IONS

Source of Ionization	Type of Discharge
I. Antecedent.	Saturation currents.
II. Collision	Glow discharge
III. Cathode radiation	Half arc (Poulsen arc converter)
IV. Anode vaporization	Full or power arc

Little is known about the time element in Fig. 2, although it is of the highest importance, and nothing is known of the time required to develop a discharge through the saturation-current and glow-discharge states in advance of flashover. The form of the field is another of the important factors in the production of flashovers as it determines where the glow discharge first appears. This is the chief source of ions that develop flashovers, and it also has much to do with the route of the flashovers.

The nature of the field form and time element of 60-cycle discharges has been demonstrated with the apparatus shown in Fig. 3. The approximate form of the field is shown in light lines. Without the metal plate 205,000 volts was required for a discharge across the gap. At slightly below 143,000 volts and with the plate connected to the lower sphere discharges resulted due to ionization from the short, blunt barb of small wire mounted on the upper sphere as shown. The shortest distance from the barb to the lower sphere was 10.5 in. (26.6 cm.) and to the plate 14.75 in. (36.5 cm.). At 143,000 volts discharges went as freely to the plates as to the sphere. Without the plate there was no brush discharge formed at the barb even at 205,000 volts—the voltage required to discharge between the spheres by the shortest route. When the plate was slightly more remote all the discharges took place between the barb and the lower sphere, and when slightly less remote, from the barb to the plate.

A flashover occurs when a streamer is built from the glow discharge to the opposite electrode. The field drives the ions of one sign forward and of the other backward. Therefore the direction of the impelling field is the chief factor governing the route taken by the discharge. The direction and amount of this field is the sum of the initial and auxiliary fields. The field between the electrodes prior to the glow discharge is the initial field, that subsequently built up from the streamer to the opposite electrode being the auxiliary field. The direction of the ion propulsion at the streamer head is coincident with the direction of the combined fields.

In the analysis of the flashover results it must be noted that, given a source of ions, 10,000 volts per inch at 60 cycles is required to maintain the streamer which is the initial stage of a flashover. The discharges from the barb to the plate were by the shortest route, having a length of 14.75 in. (36.5 cm.), while those from the barb to the sphere did not traverse the shortest route of 10.5 in. (26.6 cm.) but covered two sides of a triangle having a combined length of 14.75 in. (36.5 cm.). Both these discharges conform to the 10,000-volts-per-inch rule.

The relative positions of the initial and auxiliary fields and the time element in the development of the glow and streamer discharges are the responsible factors in the selection of the paths. In the case of the discharge from the barb to the plate the directions of the two fields are coincident throughout and the discharge develops in the direction of the initial field. In the discharge to the sphere the two fields differ in direction by more than 90 deg. The glow discharge and streamer growth at the barb start suddenly near the 60-cycle wave crest that has already established a strong initial field, and there exists no auxiliary field. The initial field drives the first crop of ions forward in its own direction toward the plate. By the time a streamer grows 3 in. (7.5 cm.) toward the plate the auxiliary field has formed from this streamer toward the sphere in sufficient strength to divert some or all of the ions toward the sphere. The race is then on, and the streamer that reaches its goal first develops the flashover.

Radio-frequency, flashover-producing streamers develop no strong auxiliary fields. The result is that this class of flashovers conform largely to the directions of the initial fields in which they originate. Sphere-gap flashovers produced with undamped 70,000-cycle voltages are shown in Fig. 4A. Barbs were mounted on each of the spheres as shown. Similar discharges were produced (Fig. 4C) without barbs by touching the sphere at the top with a hard-rubber rod. Because of the higher specific inductive capacitance of the rod the air between it and the sphere was overstressed. A glow discharge developed followed by a flashover to the top of the other sphere. Thus high-frequency discharges depart

little from the route of the tubes of force in the field in which they originate.

Other things being equal, the voltage consumed through the 60-cycle streamers is low and that through the radio-frequency streamers high. The result is that the potential of the head of a 60-cycle streamer will be higher than the potential in the adjacent region of the electric field, and a strong auxiliary field is formed and terminated upon the streamer head. The potential of the head of a radio-frequency streamer will be correspondingly nearer to the potential in the adjacent field and the resulting auxiliary field at the head of the streamer will be correspondingly weak. It is for these reasons, generally speaking, that low-frequency discharges develop along the shortest routes between electrodes of the conductor or condenser circuits and the high-frequency discharges develop more often through the far longer routes of the tubes of force in which they have had their start.

The long suspension-insulator flashovers produced by the oscillator in Fig. 5C established the fundamental that a discharge thus produced is also confined approximately to the route of the tube of force in which it obtains its start. Small vertical cylindrical shields were mounted on either side of the insulator string and capped with pin-type insulators. The start of discharges into the tubes of force that extend upward near the insulator was thus prevented at the voltage that started the discharges through the tubes of force that lead downward and terminate on the top of the cross-arm immediately below.

FIG. 4—HIGH-FREQUENCY DISCHARGES COMMONLY FOLLOW INITIAL FIELDS

A—Discharges between barbs mounted on spheres indicate the form of the field of force and show the effect of initial fields on the paths of discharges.

B—Remarkable photograph showing how a 60-cycle discharge started by the initial field is diverted downward upon the lower sphere by the auxiliary field.

C—Two stages of discharge—streamer discharges above and arc below.

The preceding set-up was modified by replacing the small vertical cylindrical shield on the side of the insulator away from the tower with one of the same length but larger diameter and by omitting the pin-type insulator cap, with the result shown in Fig. 5D. Streamers were built up upward across the insulator end to the tower cross-arm, thus producing heavy cascades and flashovers.

A study of the flashovers of the V-strings in Fig. 5B throws light on the nature of the time element as a fundamental in discharge phenomena. This photograph reveals the fact that during the interval in which the isolated streamer grew to a length of 84 in. (213 cm.) the associated streamers, planted thickly around the 1-in. (2.5-cm.) conductor, grew to a corresponding length of only about 5 in. (12.5 cm.). In another set of flashovers studied but not photographed the formation of isolated streamers was prevented by shields and a dead-end sphere. It was then observed that some of the associated streamers about the line conductor outran the others and developed lengths exceeding 3 ft. (1 m.) during the time in which the rest did not grow beyond 5 in. or 6 in. (12 or 15 cm.)

Arcs on Big Creek Lines Followed Initial Electric Field

The 150,000-volt Big Creek lines of the Southern California Edison Company which were inspected with reference to flashovers are suspended from insulator strings which are neither long nor short (nine units in suspension and eleven in dead-ends). The marks that had been left on insulator hardware, line conductors, towers and ground conductor where flashovers had occurred indicated clearly that the flashovers struck clear of the insulators in most cases. The routes along which they developed were largely determined by the initial field and to a small extent only, if at all, by the secondary field. This promises well for the success of the longer strings that will be used to support the 220,000-volt lines, particularly when the hardware and shields are so developed that corona formation will not occur at voltages much below those required to produce flashover. Powerful divergent electric fields will thus be established at the conductor end of the insulator in advance of streamer formation. At the start streamers will, therefore, be driven outward and well away from the properly shielded or graded insulators by the initial field when produced by overvoltages of the transient radio-frequency type. The same flashover-direction control will hold for overvoltages of the sustained 60-cycle form when sufficient care has been taken to determine outward in lieu of inward directions of the auxiliary fields accompanying 60-cycle streamers.

During a storm in which lightning struck in the vicinity of a transmission line near one of the power houses an overvoltage transient was thrown onto the line that passed the electrolytic lightning arrester having a 13-in. (33-cm.) horn gap, entered the station and discharged over, but free of, a bushing, 48 in. (120 cm.) to ground. This is strong evidence that the lightning stroke set up an oscillating transient in the line that produced an association of slow-growing glow and streamer discharges at the gap of the arrester and a rapid 48-in. (120-cm.) flashover, race-winning, isolated streamer at the bushing within the power house.

Direction of Flashovers May Be Controlled

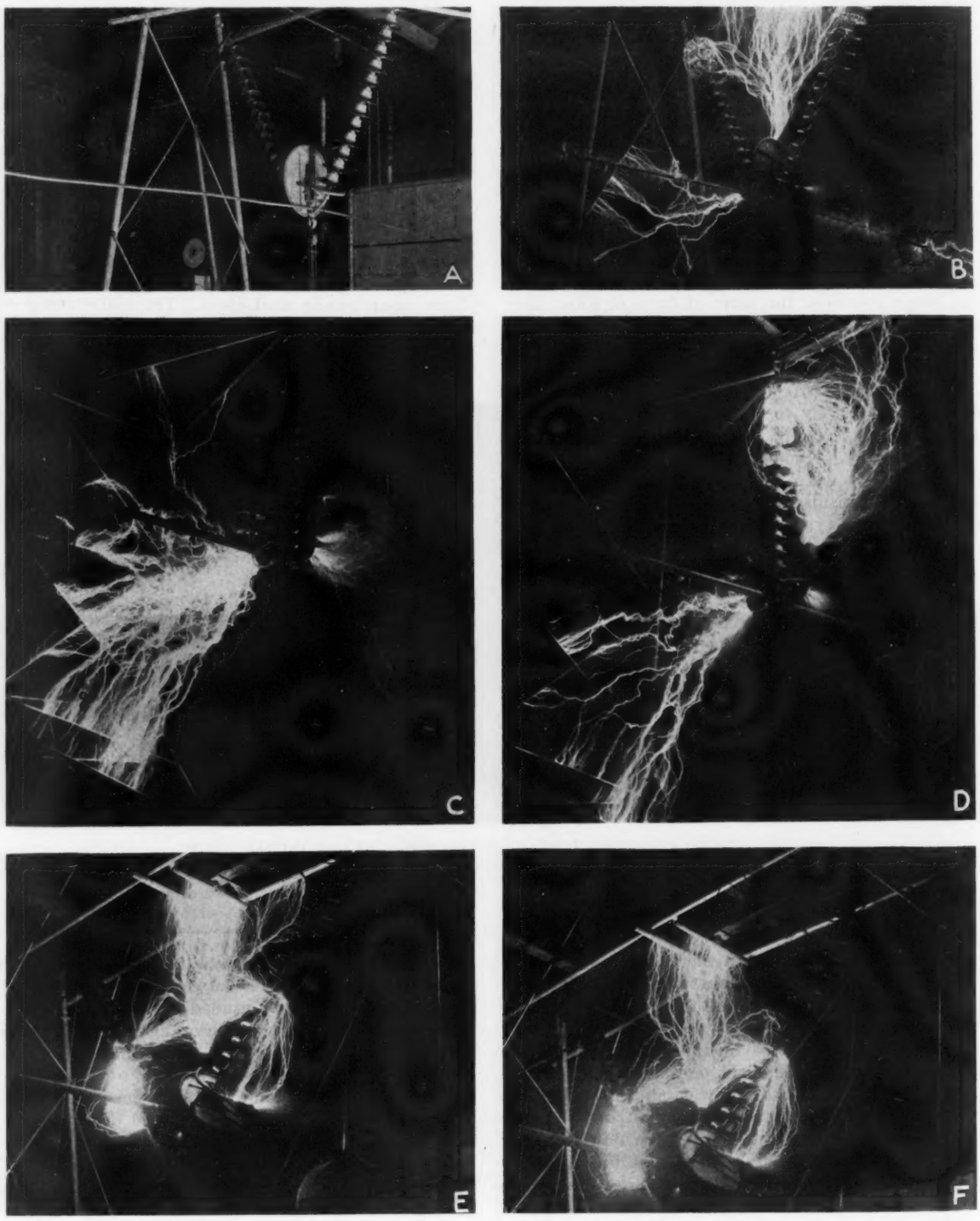


FIG. 5—SHAPE OF ELECTRICAL FIELD SURROUNDING INSULATORS DETERMINES DIRECTION OF FLASHOVERS

A and B—This arrangement of insulators has been proposed for one of the first lines that will operate at 220,000 volts. This is a V-string with thirteen units in each section, having a larger metal disk between the sections and a smaller shield at the bottom of each section.

C—Proper design of shields in this case causes the discharge to be deflected to the tower and away from the insulators. Small vertical shields are mounted on either side of the insulator string and these are capped with pin-type insulators.

D—Slight change in arrangement from C causes heavy cascading over the upper units of the string of suspension insulators. In this case one of the pin-type insulators has been removed and a blunt pin substituted.

E and F—This is another type of design that has been suggested for the 220,000-volt lines. The similarity of discharges indicates that one arrangement will always give practically the same flashover. In this set-up there are fourteen disks in each leg and a large metal disk and a metal ring at the bottom of each insulator section.

A space factor of some sort exists which cannot be defined as yet, but it should be noted that Figs. 5C and 5D, which are of two successive tests on the same set-up, are astonishingly alike and that it is difficult to distinguish one from the other. The counts made by witnesses of the number of discharges that occurred over corresponding routes are summarized in Table II. While there were but thirty wave trains, these, being heavy, all parted, each taking successively several different routes.

TABLE II—ROUTES TAKEN BY FLASHOVERS IN FIGS. 5C AND 5D

Location of Flashover	Path Length In.	No. of Discharges Fig. 5C	Fig. 5D
Right outside ring to insulator top	36	11	12
Right inside ball to insulator top	35	25	25
Left inside ball to insulator top	38	18	18
Left outside ring to insulator top	35	30	30
Center ball to cross-arm	58	26	17
Total	..	110	102
Groups of wave trains			30

The close agreement between the two sets seems to indicate that the discharge along one route cleans up the ions there so completely that the discharges immediately following can be more readily established by other routes less recently used, thus accounting for the wide adoption of routes and the virtual repetition of discharge groups when the numbers of discharges in each group amount to thirty or more.

CONCLUSIONS

From the foregoing tests the following conclusions have been reached:

1. The classical studies of Steinmetz and Hayden and of Peek in regard to the time factor in electrical discharges should be greatly extended so that the results will be directly applicable to insulator flashovers.

2. The strength and direction of the aggregate electric field during the production of a flashover are the chief factors in determining the route of such flashover.

3. In many forms of applied overvoltage and of electric fields thereby established time is more important than space in the determination of the route that will be taken by the flashover.

4. Where flashovers are developed in quick succession (one per second) there exists a space condition that is a factor in the control of the flashover route.

5. The value of the average voltage gradient (kilovolts per centimeter or inch) required to produce flashovers in air at sea level and ordinary temperatures varies between wide limits: 1,000 to 14,000 volts per centimeter (2,500 to 35,000 volts per inch).

Adoption of Metric System Again Up at Washington

A SUB-COMMITTEE of the Senate committee on manufactures has been designated to conduct hearings on a bill by Senator Ladd of North Dakota providing for the compulsory adoption after ten years of the metric system of weights and measures. Senator McNary of Oregon will act as chairman of the subcommittee. The other members are Senator Weller of Maryland and Senator Jones of New Mexico. It is the intention to have limited hearings shortly after the congressional recess so that the proponents and opponents of the legislation may be heard and a stenographic record of the hearings circulated. Further hearings are planned for the December session.

Rotary Electric Furnace Shows Marked Advantages

Nash Motors Company Will Install Another—Displaces Oil-Fired Furnaces for Continuous Heat Treating, Annealing and Carbonizing

BY ALAN D. DAUCH
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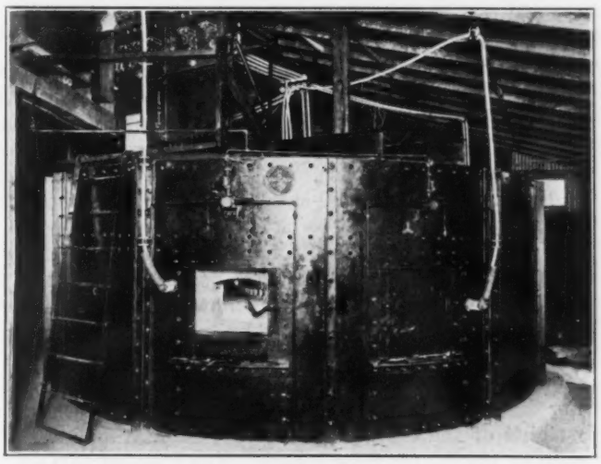
TO PERMIT continuous heat treating, annealing and carbonizing the Nash Motors Company, Kenosha, Wis., recently placed in operation a rotary electric furnace which is of unusual design and which has many advantages over the oil-fired furnaces that have been displaced. The results obtained in the past few months' operation have been so satisfactory that the company has arranged to install another furnace similar to it.

The fact that the equipment had to be designed so as to be able to heat-treat automobile parts varying in size and characteristics from a small spring clip to a large front axle made the problem of design unusually complex. A rotary furnace with a moving hearth in the form of a continuous annular ring was finally selected as being best suited for all purposes. Accordingly, this furnace was laid out so as to have the following physical dimensions: Over-all outside diameter, 19 ft. (5.7 m.); over-all outside height, 7 ft. (2.1 m.); outside diameter of rotating hearth, 15 ft. (4.5 m.); inside diameter of rotating hearth, 5 ft. (1.5 m.); width of hearth, 5 ft. (1.5 m.); height of heating chamber, 2 ft. (0.6 m.). The furnace walls are of standard construction, bonded throughout with "Adamant" cement and incased by sheet steel reinforced with structural beams. The hearth rotates on a series of roller bearings—twenty in number—placed at regular intervals about the circumference of the table. Roller bearings on the inner wall of the furnace prevent side play of the hearth. The clearance space between the hearth and the furnace is closed by means of sand seals to prevent infiltration of air.



CHARGING AND DISCHARGING DOORS IN FOREGROUND; CONTROL EQUIPMENT ABOVE

The furnace is provided with two adjacent doors, pneumatically operated, one for charging and one for discharging. A baffle wall extends across the heating chamber between the two doors to prevent the heated

pieces being chilled when cold material is charged. The hearth is driven by an electric motor through gear reduction machinery so as to give six speeds of rotation varying from one complete revolution in thirty minutes to one revolution in seventy-five minutes.

HEATING ELEMENTS DISTRIBUTED TO GIVE TWO ZONES

The electric heating equipment consists of two sets of nickel-chromium ribbon-heating elements mounted on the inner and outer walls of the furnace. The first section or heating zone extends approximately two-thirds the distance around, starting at the charging door, and has a connected load of 210 kw. The soaking zone or soaking section has a connected load of 60 kw. installed for the purpose of supplying the radiation losses in this part of the furnace and giving enough additional heat to bring all of the charge to a uniform temperature. The main or heating zone is run at a temperature of 1,580 deg. Fahr. and the finishing or soaking zone at 1,525 deg. Fahr. The heating elements in each zone are separately connected to a General Electric control board. The temperature of each section is automatically controlled and recorded by means of a two-point Leeds & Northrup potentiometer. The temperature of each zone can be automatically maintained at any value between 200 deg. Fahr. and 1,800 deg. Fahr. The total connected load of 270 kw. is connected to 440-volt, three-phase, 60-cycle power service, and 110-volt, single-phase, 60-cycle power service is used for control purposes.

Under actual operating conditions 11.75 lb. (5.2 kg.) of steel has been heated to 1,525 deg. Fahr. and soaked at the same temperature per kilowatt-hour consumed. This is at the rate of 170 kw.-hr. per ton. The charge per hour consists of approximately 3,000 lb. (907 kg.) of various automobile parts such as spring clips, steering knuckles, connecting rods and front axles. The weights of the different parts vary from 3 lb. (1.3 kg.) each to 180 lb. (81.6 kg.) each. The time during which the pieces are in the furnace naturally depends on the cross-section and weight of the particular part. This feature of time in the furnace is very aptly taken care of by the different speeds at which the hearth may be revolved.

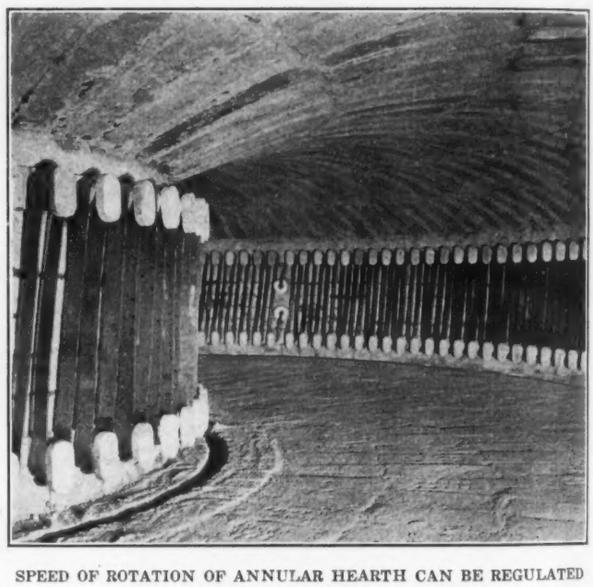
OPERATING CYCLE OF FURNACES AND COMPARISON WITH OIL-FIRED UNITS

After the furnace operator has removed the final charge of material to be hardened and the main line switch is opened, a charge of grey-iron castings and steel forgings is placed in the furnace over night for annealing purposes. The only heat employed to anneal these parts is the heat drawn from the furnace walls. The temperature of the charge and the furnace in the morning averages about 1,000 deg. Fahr. The annealing material is then removed and the furnace is again utilized for hardening operations. Approximately forty minutes is required to bring the furnace temperature from 1,000 deg. Fahr. to 1,525 deg. Fahr. This furnace is also to be used for carbonizing cam shafts. It is planned to charge a total of 18,000 lb. (8,165 kg.) of carbonizing boxes, packing and material in the furnace at one time.

Some of the advantages of this furnace over the box-type oil-fired furnaces displaced follow: Owing to the uniform rate of heat absorption, distortion on long parts (axles) has been entirely eliminated. In the fuel furnaces, regardless of the fineness of control, there was no assurance that all of the parts in the furnace had reached the proper temperature or had not been overheated. In this electric furnace the work is charged at one place and travels for a predetermined time around the circumference of the furnace before it can be withdrawn. The temperature, heating time and rate of heating are under absolute control and are duplicated with mechanical precision day after day.

Scaling has been virtually eliminated in the electric furnace. The material annealed in the rotary electric furnace now requires only a "flash pickle." This operation formerly required three to four hours of time.

Since the electric furnace has been used the scleroscope hardness test on all parts has been increased from two to five points. Furthermore, the quality of the material by individual test has proved to be more uniform in strength and other physical properties. The item of labor for handling the same number of parts has been reduced from six to three men, and up to the present no material handled in this furnace has been rejected because of faulty heat treatment.



SPEED OF ROTATION OF ANNULAR HEARTH CAN BE REGULATED FOR PRODUCTS OF DIFFERENT SIZE

The most important advantage observed by the metallurgical men who have charge of this equipment is that they have been able to reduce heat treatment to a mechanical operation. The furnace operator is supplied with a heat-treating ticket on which are written the number of pieces, drawing number, speed of rotation of furnace hearth and temperature. It is then an assured fact that the particular product will receive the specified treatment regardless of any of the usual conditions affecting a heat-treating operation. Furthermore, working conditions have been vastly improved by the design of the furnace with the resultant increase in productive effort on the part of the furnace attendants.

From the electrical superintendent's viewpoint this electric furnace possesses other advantages worthy of consideration. For instance, owing to the unity power factor and high load factor this equipment has materially benefited power-factor and load-factor conditions throughout the entire plant.

The furnace was designed and installed by the George J. Hagan Company, furnace and combustion engineers.

Making Better Engineers of College Men

Power to Think Is More Important than Mind Filled with Facts—Sound Basis in Fundamentals Necessary—Attitude of Service and Co-operation Most Desirable Characteristic of Young Engineer

MANY constructive suggestions for improving the fitness of graduates of engineering schools were given by prominent electrical engineers in answer to a letter sent out recently by the educational committee of the American Institute of Electrical Engineers. Among these suggestions two stand prominent. The first is that the college should teach thoroughly a few fundamentals rather than impart a large store of facts and should drill the student in analyzing any problem and solving it by applying these fundamentals. The second is that the graduate should cultivate above other things the attitude of service and co-operation.

It was asserted in nearly all the answers that development of the power to think is more important than the accumulation of information no matter how great the amount. The whole field of engineering and of commerce and business demands analytical ability of the highest order. Therefore the capability to analyze an unknown problem, first recognizing all the elements present, and then to progress step by step in considering each factor and its bearing on the objective sought, is a prime requirement for personal success in engineering and industry.

FUNDAMENTALS MUST BE MASTERED

Although it is advocated that the students shall be grounded in fundamental theory, it is not the desire to make them theorists. As one engineer expressed it, "Ground them thoroughly in the fundamentals of physics and mathematics, both to be taught by engineers and not by physicists and mathematicians." Another letter brought out the point that there is need for more professors who are practical engineers, who have rubbed shoulders with the world and who are capable of doing the jobs they are trying to teach students to perform.

It is of the utmost importance that there be a certain amount of business and legal training in the engineering curriculum. The students should be taught banking, the laws pertaining to contracts, accounting and many aspects of business of which the average college-trained engineer knows little or nothing. In every profession it is the all-around men who are at the top, the men who are interested in and know other specialties besides their own. Anything which contributes to the development and accentuation of personality through discipline and culture will eventually be more valuable than that which contributes to the equipment of the specialist. A better knowledge of English is desirable in order that the engineer may express himself clearly and definitely and put forward in a concise manner the reasoning which he has in mind.

The old type of manual training in colleges is considered to be to some extent a waste of time. In place of this it is thought better to have the student do one year's work in some manufacturing establishment or in some branch of practical engineering work allied with the course which he is taking.

Service, in the highest sense of the word, was thought by virtually all who answered the letter to be the basic philosophy that should be impressed on the student to serve as a guide in future work. After selecting the work which he will follow, the student should put forth untiring effort in preparation to become a master of it, with the predominating thought always in mind to give the best service in his ability. Such a resolution to give service implies cheerfulness in co-operation, self-helpfulness, determination and consideration for others. This attitude outranks ability in every normal competition. There may be instances in which ability alone might win, but never in the team work which is necessary to modern industry and society. The engineer must learn to build up and construct, helping others rather than criticising and tearing down, and to get his reward from the co-operative efforts of others and the confidence they place in him. The supreme importance of applying plain common sense in all problems should be constantly kept in mind. This common sense should be applied in all affairs of life, and the student should learn the value of mixing with his fellows and taking a lively interest and active part in all of the affairs of citizenship.

The engineer should never cease to be a student. The time for absorbing knowledge does not end when the college course is completed, but extends throughout life.

Health is obviously essential to success, and the importance of conserving the physical powers should be emphasized.

Interesting quotations taken from the replies are made in the following paragraphs, the name of the writer preceding each quotation:

B. G. LAMME: "In the first place, I find that the vast majority of technical graduates from our schools have no real grasp of fundamental principles. These principles may have been taught to them, but have gone over their heads, or they have not realized that these were fundamental. The principal reason for this lack of realization, I think, lies in the fact that the students are not trained in the use of such principles. Possibly many of them would not have the grasp even if they were trained in the use of fundamentals, but the general indications that I have found are that they have never been drilled in the use of the fundamental principles. I can cite several instances in my own experience which may serve to illustrate the point I have in mind.

ONE MAN WHO USED THE FUNDAMENTALS TO ADVANTAGE

"In my own work in college, where I took up a course in mechanical engineering, the professor at the head of the department, S. W. Robinson, had a tremendous reputation among the boys as a man who knew practically everything. In other words, the general feeling was that he was a 'wizard' in engineering matters. Naturally, hearing such things, I at first held the same

opinion. However, as I got to know him better—and eventually I was very close to him in engineering matters—I acquired an entirely new opinion of him. To my surprise, I found that there were a vast number of subjects about which he apparently knew little or nothing, but, nevertheless, on such subjects he could reach conclusions quickly and reliably. For example, in endeavoring to find the source of this ability, and also how he got at things, I devised from time to time a number of special problems, which I sprang on him on suitable occasions, usually in private. On such problems I had done considerable work and had encountered some difficulty, which was the occasion for presenting the matter to him. I found hat in virtually all cases when I first presented such a problem to him he knew practically no more about the subject than I did, or even possibly less, but that almost invariably, after a little study, he could solve the difficulty for me and explain it to me clearly. In getting at how he did it I came to the realization that he simply relied upon a few fundamental principles and that he brought these to bear directly on the solution of the problems I put up to him. In many cases I had also gone over these same fundamental principles, but had no realization to what extent they could serve as tools for handling difficult work. Gradually, in watching Professor Robinson's work, I came to the knowledge that his real strength did not come from any broad general fund of information, but rather from the fact that he had apparently a limited amount of information of a sort from which he could construct almost anything he wanted. This gave me an entirely new idea of the meaning of education. With him it was a case of having a few general-purpose tools, which he could use in all manner of ways to construct a desired result; whereas, compared with him, many so-called educated men had a vast collection of tools practically none of which they knew how to use.

"A very broad-spread idea, which should be combated, is that the boy takes a college course for the purpose of collecting information. This idea is not only a mistake but is a very harmful mistake. A boy goes to college for the purpose of learning to use his head, not merely to fill it. Much of the college training today is in the nature of a filler, and much of the filler is worthless in the way of future advantage. If the boy is to be an engineer, presumably he will want to lead in something and his future work may consist largely of things which do not yet exist. Much that he acquires at school is simply the story of what is already done; that is, it covers what is already a story of the past. The value of this past work lies mostly in the principles upon which it is based, and these principles are very liable to be carried into the future. Therefore, if the college boy can be trained to set aside the vast mass of facts and results of the past and simply recognize a few fundamentals upon which these are based, he will be fairly well equipped for his future work."

FUTURE OF DIFFERENT LINES SHOULD BE EXPLAINED

CARL HERING: "During the year preceding that in which the student must select his particular branch of engineering he ought to attend a course of lectures describing what each of the different branches of engineering comprises; that is, what kind of work he would have to do, what studies he would have to take up, what the probable field for employment is, what the possible field of development is, etc. This should embrace not only the few general branches of engineering, like electrical, mechanical, civil, mining, chemistry, architecture, etc., but should also include the subdivisions; in electrical engineering, for instance, such subdivisions as the generation and distribution of power, design and construction of machinery, telegraphy and telephony, furnaces, electrochemistry, teaching, salesmanship, administration, etc. At the end of such a course the student is better able to make a correct choice, and his teacher is better able to advise him and to sort out the wheat from the chaff. A student will always do best in that branch in which he is most interested, but he often fails to make the correct choice because at the time of making it he has too little knowledge of the kind of work and study required in the various branches."

MORE PRACTICAL PROFESSORS ARE NEEDED

H. C. HEATON: "First, there is a need for more professors who are practical engineers, who have got out and rubbed shoulders with the world and who are capable of doing the job they are trying to teach their students to perform.

"Second, in order to secure practical teachers it will be necessary to compete from a monetary standpoint with the industries, and this means that we have to pay attractive salaries in the teaching profession.

"Third, there should be the closest co-operation between industry and the institutions of learning, and if necessary, industry should assist in liberally endowing them in order to make the fullest use of their facilities for research work and the development of new fields of progress. This alliance of science and industry brought Germany to the very pinnacle of commercial success just prior to the war.

"Fourth, no engineering course should be considered complete without requiring the student to do one year's work in some manufacturing establishment or in some branch of practical engineering work allied with his own course.

"It is of the utmost importance to include a limited amount of business training and legal training in the engineering curriculum. Engineers as a class are deficient in knowledge of these subjects.

"Above all, college spirit should tend toward democracy and not to exclusiveness. More than one college graduate has prejudiced employers toward his kind by consciously or unconsciously cultivating a slight air of exclusiveness."

GANO DUNN: "Ground students thoroughly in the English language, a lack of command of which in writing and speaking is the greatest single defect in the college training of most engineers. It is not enough for an engineer to be skilled; he must make his skill prevail, and the power and culture that come from familiarity with English are tremendous forces in the success of an engineer."

E. H. BANGS: "If some one thing is needed now to help students, it would seem to be that they should know more of the truth about themselves, particularly as to their location in the picture and as to its perspective. It is very doubtful if they generally appreciate that life is a continuous educational process and that nothing definitely separates the particular part of life that they spend in college from what went before or what is to follow. It is simply a period when it is easiest to learn certain kinds of things, and coming as it does when students have little earning power, it is a very convenient time to allow them to concentrate on the accumula-

tion of knowledge, in much the same way that kindergartens are found to be convenient for younger students. That part of their education which they use in their profession could perhaps be obtained elsewhere and at some other period, but not so easily and not so efficiently, and that is the impelling motive for colleges. That part of a student's education which is received in college is terminated by economic reasons and not by the capacity of the student to learn or of the college to teach."

RALPH D. MERSHON: "Emphasize reliability. This includes probity, of course. But it also includes accuracy and initiative."

L. T. MERWIN: "At the risk of the accusation of being a gross utilitarian, I would state that the criterion of all engineering work in the industrial world today is 'Will it pay?' This measuring rule is a flexible one and may involve a prophetic insight of the future economic conditions; it may further involve an idealistic conception of the value of beauty of form and arrangement; or again it may be a discernment of the value of social and welfare relations in the economic life of the community. In the last analysis, however, engineering work must pay or it is futile."

S. D. SPRONG: "Greater emphasis should be placed on what may be called the economics of engineering. That is, generally speaking, engineering is only a means to an end and not the end in itself, which usually has a place in the economic structure of the locality or corporate system. Its value will be measured by how efficiently it articulates with the remainder of the project and its all-around economy as a part of the whole."

Reservoir Will Control the Flow of the Chippewa River

SEVERAL interesting features are included in the license granted recently by the Federal Power Commission to the Wisconsin-Minnesota Light & Power Company for a storage reservoir (Project No. 108) on the Chippewa River. The reservoir will have a capacity of approximately 257,000 acre-feet and a water surface of 26 square miles. The water level will be raised 35 ft. at the dam.

The proposed method of operating the reservoir is to close the gates and store water during the high-water period from March to July. About 140 sec.-ft. will be released during the medium low-water period from August to November, and the remainder, about 230,000 acre-feet, will be released so as to maintain a steady flow during the months of December, January, February and March. In this way the reservoir will control virtually the entire flow of the stream. There will be added over 800 second-feet to the flow of the river during the winter months and about 140 second-feet during the medium low-water period.

There are three developed sites below the dam with an aggregate installed capacity of 53,200 kw., one of which is the Wissota plant. There are also eight undeveloped sites with an aggregate head of 247 ft., two of which are owned by the company. All of these plants will be benefited by the proposed storage reservoir. Under the method of regulation as described, the total output of the three developed sites will be increased 8 to 12 per cent. The amount of continuous power available will, however, be increased about 70 per cent.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Experiences with Ungrounded Secondaries

To the Editors of the ELECTRICAL WORLD:

The writer believes that it would be of great benefit to municipalities to ascertain the risk to life and danger of fire that result from the failure of central-station companies to ground the secondaries of their transformers. It would be worth while to get an expression of opinion from those experienced in the field on a matter of such vital interest, especially when the points suggested below are considered.

In one case with which the writer is familiar the central-station company gives a straight two-wire, single-phase, 60-cycle, 110-volt service from a 2,300-volt distribution network, no three-wire, 220-volt service being given. The secondary is not grounded in any manner whatever. The core of each transformer is, however, grounded, the idea being that in event of surge from lightning in the primary circuit it will flash over to the core first, as the insulation between the core and the primary in the transformer is made much weaker than between the primary and the secondary. This theory does not seem correct in view of the fact that during thunderstorms chandeliers have repeatedly "cracked" and shot out fire caused by strokes of lightning, to say nothing of the fire danger arising from the severe strain on insulation behind the walls and floors of the dwelling.

In addition to this, repeated shocks have occurred when turning on lamps where the floor was damp and the fiber insulation of the socket was moist, as in cellars, garages, etc. On investigating a small blue spark was found to jump about $\frac{1}{16}$ in. from either side of the line to ground, showing there was static leakage through the transformer and also revealing the fact that all the wiring was under a strain of about 2,300 volts to ground, a potential much higher than the insulation was designed to withstand. There is little doubt that this is detrimental to the rubber insulation of wires installed in conduit where it is grounded. If it is not grounded, the conduit will become more or less charged above earth potential.

The writer knows of one particular case where the insulation on a small $\frac{1}{4}$-hp. motor directly connected to a water pump was broken down by this strain of 2,300 volts, the frame of the motor being grounded through the water pipes running to the pump. In the event of lightning striking a primary circuit it is needless to say that the strain of 2,300 volts to ground is greatly exceeded and there is a danger of breakdown altogether, which would allow the primary current to flow directly into the secondary.

The writer believes that the only safe and humane course is for central-station companies to ground their secondaries, even if it will cost them something; then

all this excess voltage will be drained off to ground. This subject has been up numerous times for discussion. Is it not time that real laws were made and enforced? Prevention is safer than damage suits. Advice as to how to proceed to get the central-station companies to eliminate this life and fire hazard would be appreciated. It would seem that the state inspector ought to have power.

V. DES ROCHES,
Electrical Engineer.

Matthews Engineering Company,
Sandusky, Ohio.

The Doctor Must Go to the Patient

To the Editors of the ELECTRICAL WORLD:

During the war public utilities were forced by necessity to incur greatly increased costs not only for labor but in capital expenditure. These capital charges cannot be made to vanish at one stroke of a pen or one flourish of a magic wand. It is evident from a commercial standpoint that the central-station industry is now suffering from a muscle-bound sales effort. For this there are two reasons: First, during the war and for a short time afterward the service was not sold but demanded; second, when deflation came its reflection on the central-station industry, with its idle equipment upon which charges must be met, was marked.

The average manager is prone to read monthly reports and balance sheets and then to lie awake at night figuring what can be done to meet the steadily growing red figures or the disappearing black ink. He awakens some morning just after the first of the month feeling that he must do something and proceeds to the office to cut down the commercial force. Next he starts to cut minor employees, with a resultant small decrease in the payroll. Then he waits for business to come back. Right here commences the real story. In the first place, business does not come back of its own accord. It is true that certain economic conditions influence its course, but none the less we must get out and bring it back. One would not expect a sick man to run to the hospital.

The problem faced by central-station commercial men is how to bring business back. First, put the commercial men to work. Make sure that the right men are on the job and receive the sympathy and encouragement that a human being needs. Commercial men need this more than any one else in the organization because when a customer has a real or imaginary grievance, and even if he indulges in abuse, the commercial man must maintain his balance and be tactful. He must stand under fire and turn a "knocker" into a "booster." It is his personality and tact that turn a liability into an asset. The banker may say that you cannot capitalize on assets of that kind, and they do not make a direct showing on the balance sheet; but the experienced manager knows the value of such an asset when he goes to the city council or utility commission with a case for decision. Actual instances could be cited where such a public policy has worked wonders in some important case.

Just putting commercial men in the field and giving them encouragement and sympathy will not, however, accomplish the desired result alone; it only helps. The commercial man must be an engineer with tact who can see a proposition through the eyes of a business man and place himself in the position of the buyer and the seller. The central-station commercial man is often too much inclined to give his prospective customer a long letter or report full of details. Although this is desirable for office records and sometimes influences the customer, it will be found far more desirable to present figures as briefly as possible since a business man thinks in abstract figures. The representative of the central-station company is not only selling a service but he is selling a gilt-edge security with a larger financial return than his customer can obtain in any other way and is placing the equity in the customer's own hands.

To illustrate, suppose you have a prospective customer whose operating expense with his own plant is $50,000 a year, and your estimate of operating expense on electric drive with purchased energy is $45,000, making a difference in favor of electric drive and purchased energy of $5,000 per year. The cost of equipment with electric motors and other apparatus to use electric power would be $20,000, and the customer maintains that the cost of electrification is too great. You are asking this man to spend $20,000 to make a saving of $5,000 a year, or a reduction of his operating expenses of only 10 per cent.

Now, suppose you went to this same man and told him you could sell him a security that would return 25 per cent on his investment, and that in addition you would place in his hands under his own control tangible property amounting in value to the full amount of the investment you were offering. What would happen? He would either think you were crazy or he would lock the door and open the safe.

But as a matter of fact the central-station company's representative is not only selling a service but is also selling a security with a large return on the investment and with no chance of losing the equity. Where can one find such an investment elsewhere?

Selling electric service is a man-sized job, yet any one with adequate knowledge and experience can bring the sick Mr. Business back to health by giving him the greatest of all tonics, a larger return upon his investment. But the doctor must go to the patient.

Worcester, Mass. W. J. KYLE.

Electrification of French Industries

To the Editors of the ELECTRICAL WORLD:

French electrical works are now busy with orders booked that compare favorably with those of the previous year. This satisfactory situation is partly due to the electrification of many enterprises in continuation of the movement started during the war on account of the perplexing fuel problem. These works are now being completed, but chiefly in the reconstruction of the devastated industries in northern France, which will be electrified on a scale hitherto quite unknown.

Steam-operated central stations are being erected in the neighborhood of the coal mines and thus guarantee the most economical generation of electrical energy possible in these districts. Numerous new installations are responsible for a steadily increasing demand.

Keeping pace with this electrical development, imports are considerable, and Switzerland especially is profiting by this situation, supplying much of the material required, particularly dynamo-electric machines and transformers.

It may be mentioned, too, that the Belgian electrical industry is working under very favorable conditions at present, employing on an average nearly one-third more workmen than in 1913. HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Effect of Temperature on High-Voltage Underground Cables

A RECENT study of high-tension cables seems to point out clearly that high temperatures cause failures, but that the cables fail more frequently while cooling than they do at the highest temperature of the day. In this study a record was kept of the total number of short circuits, cable failures and interruptions on the 13,000-volt electric system in Baltimore for the years 1914 to 1920, both inclusive. An interruption was recorded whenever service was cut off from a customer owing to a short circuit on the 13,000-volt system. It was noted that the frequency of short circuits varied for different months of the year, being greatest during the summer months. In order to show just what influence the different seasons of the year have all of these failures were combined in one curve (Fig. 1).

It will be seen that the line showing the number of cable failures has the same general shape as the one showing the mean average temperature, except during November and December, this being the season of peak load, which causes extra heating in the cables and partially offsets the cooling effect of the atmosphere.

The study having shown that a large percentage of cable failures are due to the effect of temperature, an endeavor was made to determine in what way this effect takes place. For several years it has been realized that the dielectric loss of high-voltage paper insulated cables increased with the temperature, and in most cables manufactured more than five years ago the dielectric loss increased so rapidly that in many cases the effect became cumulative and the temperature increased much more than in proportion to the load, many failures resulting.

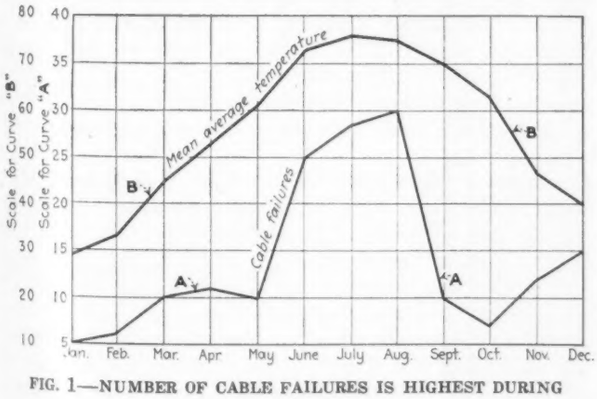


FIG. 1—NUMBER OF CABLE FAILURES IS HIGHEST DURING HOT WEATHER

However, cables that are manufactured today are comparatively free from this trouble owing to the lower dielectric loss at the higher temperatures resulting from the use of better insulating materials. Moreover, on plotting the curve in Fig. 2 showing the number of failures that occurred during the summer at each hour of the day, it was noted that the failures did not always occur during the heavy-load period when the cables were hottest, but on the contrary, the failures more often occurred during the light-load period. Not only does the maximum number of failures occur during the period of light load, but the tendency is for them to occur when the load is decreasing and the cables are cooling off. Of course, the temperature of the duct line does not drop as soon as the load decreases on the cable, but the temperature of the copper starts to drop as soon as the load starts to drop.

The conclusion drawn is that the change in temperature causes expansion and contraction of the conductors

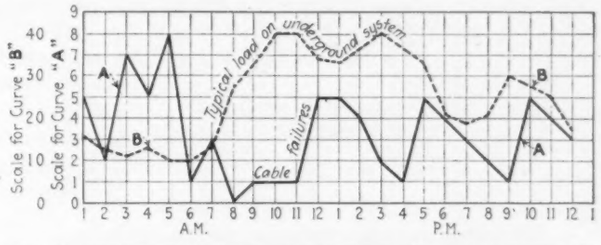


FIG. 2—GREATEST NUMBER OF FAILURES OCCURS AS CABLE IS COOLING FROM HIGH TEMPERATURE

and insulation, which sets up a movement in the cable and causes the failures. This theory is strengthened by the fact that most of the failures occurred in manholes and exposed sections of the cables, usually at bends. It is quite evident that most of these failures were due to the effects of temperature and, since the temperature in the manholes is usually lower than that in the ducts, temperature has some other effect tending to cause failures other than that of increasing the dielectric loss. The conductors, on account of their spiral form, would tend to open up as they expand and draw together as they contract, which effect would be to exaggerate at bends, and very probably many cable failures have been due to this cause.

R. H. LANG,
Chief Operator.
Consolidated Gas, Electric Light & Power Company,
Baltimore, Md.

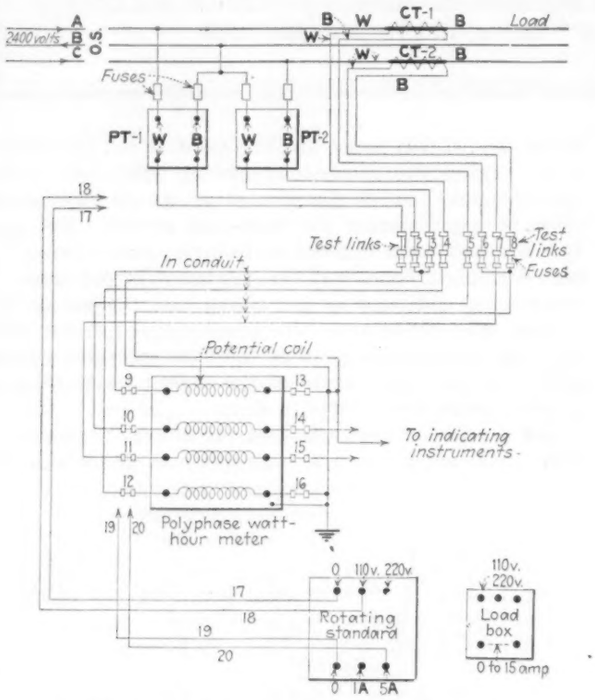
Installation Test on Watt-Hour Meters

A SIMPLE and reliable method of making installation tests on watt-hour meters is used by the writer. This method checks the connections of instrument transformers and meter, the accuracy of meter and the power-factor condition of the circuit. Only a rotating standard and a load box are required for the test. The line on which the meter is installed must be carrying a load. To help in the explanation of the method the accompanying drawing has been made. It shows the correct connection of a watt-hour meter and potential and current transformers. It shows also the rotating standard with leads numbered. Use the 1-amp. coil of the rotating standard whenever possible and

the 220-volt coil for checking voltage on potential transformers for the first time.

1. The first step is to note that the meter is running.

2. Is meter connected to the right potential transformers? Open the potential test links 1, 2, 3 and 4. If the rotation stops, these are the correct transformers.



CONNECTIONS FOR CHECKING INSTALLATION OF WATT-HOUR METER

3. Is the meter connected to the right current transformers? Short-circuit the upper studs of the current links 5, 6, 7 and 8. Open the links. If the rotation stops, these are the right current transformers.

4. Is each element of meter operating? Open test link 1 and note direction of rotation. Close link 1 and open link 4; also note direction of rotation.

5. Are current transformers correctly connected on 2,400-volt side? The leads with polarity marks should be connected to the incoming side of the bus or line.

6. Are potential transformers correctly connected on 2,400-volt side? Check polarity marks and see that same relative connection is made on the 110-volt side.

7. Are potential transformers giving 110 volts, three-phase, or 110/220 volts, single-phase? Connect leads 19 and 20 to studs of link 10 and open 10. Touch leads 17 and 18 to 1 and 2, to 3 and 4 and 1 and 4. If single-phase 110/220 volt, speed in first two cases will be one-half speed in last case.

8. Are leads from potential transformers connected to corresponding leads on meter? Connect curent coil (leads 19 and 20) of rotating standard to top and bottom stud of link 10. To test potential wire 9 connect potential lead of standard 17 to link 9 and lead 18 to link 1. No rotation shows that the wire connects from 1 to 9, which is correct. Similarly touch 17 to 2 and 3, and 18 to 13 and 16. No rotation indicates correct connection. Again, connect 17 to 4 and 18 to 12. No rotation indicates correct connection.

9. Are proper leads run from the current transformers to the meter current coils? If no indicating instruments are in the current circuit (links 13, 14, 15 and 16 are connected together and grounded), the secondary side of the load box (with primary open) should be connected to links 14 and 15. Place potential leads 17 and 18 across potential links 1 and 2. Touch lead 17 to link 5 and lead 18 to link 10. No rotation indicates that this current wire is correct. Likewise touch 17 to 6 or 8 and touch 18 to ground. No rotation indicates correct connection. Then touch 17 to 7 and 18 to 11. No rotation means correct connection.

10. To determine if a current lead is grounded. First, to test the lead which runs from 5 to 10, short-circuit top studs of links 5 and 6. Open links 5 and 10. Connect 19 and 20 across link 11 and open this link. Touch lead 17 to 1 and touch 18 to open link 10 at wire coming from 5 (not at meter). No rotation indicates no ground. Likewise the other lead from 8 to 11 may be tested.

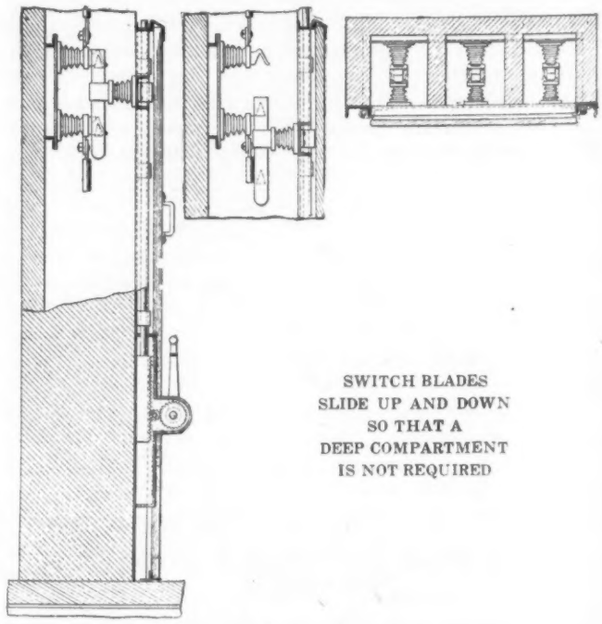
11. Make calibration test in usual way. Meter should be tested from test links and not at meter studs. Each element is tested separately and finally in series. The load impressed on each element is 100 per cent, 50 per cent and 5 per cent. Never remove meter covers except to make calibration correction.

The tests described can be simplified greatly and extended to indicating instruments, etc. The tester should be given a chart showing results to be expected from various connections of meters and transformers.

Texas Power & Light Company, A. R. HAPPOLDT.
Dallas, Tex.

Disconnecting Switch Operated in Shallow Compartment

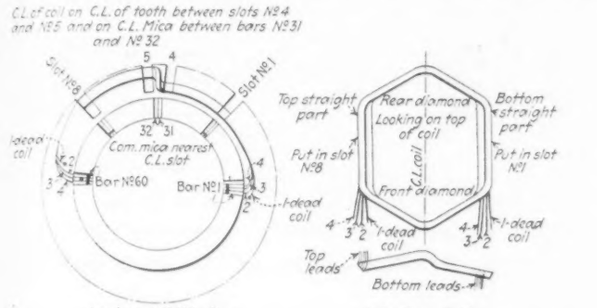
A DISCONNECTING switch which may be installed and operated in a very shallow switch compartment has recently been developed. In this switch the disconnecting blades are mounted on a frame which is set in a vertical direction to make or break the circuit. Operation of the switch is accomplished by means of a handle geared to a rack which carries the frame holding the movable contacts. A patent has been issued on this switch.



SWITCH BLADES SLIDE UP AND DOWN SO THAT A DEEP COMPARTMENT IS NOT REQUIRED

Diagram to Simplify Connecting Commutator of Series Motor

IN WINDING a direct-current motor it is very important that the connections are correctly made from the windings to the commutator. A diagram for showing just how to make these connections should be drawn up beforehand to avoid mistakes. The accompanying illustration shows such a diagram made for a series motor. In order to fill in the diagram, if the windings are not too badly damaged, it is the common practice of the winder to note the throw of the leads


C.L. of coil on C.L. of tooth between slots №4 and №5 and on C.L. Mica between bars №31 and №32
Slot №5
Slot №1
Com. mica nearest C.L. slot
Bar №60
Bar №1
Idead coil
Top straight part
Rear diamond Looking on top of coil
Bottom straight part
Put in slot №8
Put in slot №1
Front diamond
C.L. coil
Top leads
Bottom leads
Laying-off Winding
1- The center line of starting coil is on center line of armature tooth between 4th and 5th slots and on center line of mica between 31st and 32nd comm. bars.
2- Starting at bar №31 count back (clockwise) to bar №1 and in this bar place lead №2, the first active coil, from bottom leads of starting coil.
3- Counting from bar №1 forward (counter clockwise) to bar №60 and in this bar place lead №3, the first active coil, from top leads of starting coil.
Winding Data
Number of armature slots = 30
Number of commutator bars = 119
Coils lie in slots №1 - №8
Leads connect to bars №1 - №60
Commutator Center-Punched on End
Locates top leads of starting coil
Locates bott. " " " "
Locates starting coil in slots №1 and №8

WINDING DIAGRAM AND INFORMATION FOR A SERIES-TYPE MOTOR

from coil to commutator bar while stripping the windings, and in this way get the desired information. This method cannot be entirely relied upon as there is a possible chance that the winding was connected wrong when it was originally wound, either in the repair shop or the factory. The only safe way is to get this winding information from the maker of the motor.

The diagram as illustrated has been worked out to show each detailed step and to give all necessary information in such a form as to be readily understood, so that the average winder can intelligently use it in winding an armature and feel sure that the work is being done correctly. The final form of this diagram herein was the result of a careful study of a number of criticisms on previous diagrams and was adopted only after being modified and changed in line with numerous suggestions made by practical men familiar with this line of work.

In rewinding motors and filling out these diagrams the following points should be kept in mind: Series motors are usually laid out for a wave or two-circuit type of winding. They may be wound with either a right-hand or left-hand coil. A right-hand coil is one where the leads come out from the right side of the coil when holding the coil with the portion to be placed in the bottom of slot toward the holder and with the air-gap side of the coil uppermost. A left-hand coil is one where the leads come out of the left side of the coil when holding the coil with the air-gap side of the coil uppermost. Armatures of the two-circuit type may be wound either progressive or retrogressive. A progressive wave or two-circuit winding is one in which the throw of the coil lead is one-half a commutator bar greater than half way around the commutator. A retrogressive wave or two-circuit winding is one in which the throw of the coil lead is one-half a bar less than half way around the commutator. For example, with 135 commutator bars, a progressive winding has a lead throw of $(135 + 1) \div 2 = 68$ bars or 1 and 69. A retrogressive winding has a lead throw of $(135 - 1) \div 2 = 67$ bars or 1 and 68. The wave or two-circuit windings always require an odd number of commutator bars. When an even number of coils per slot are used there will always be an idle or dead lead. When an odd number of coils per slot are used and there are an even number of slots on the armature there will always be an idle or dead lead. When an odd number of coils per slot are used and there are an odd number of slots on the armature there will never be an idle or dead coil.

The alignment of the armature slots or teeth with respect to the commutator mica or bar is as follows: (1) With the coil throw even and the lead throw even, the center line of the tooth will line up with the center line of the mica; (2) with the coil throw odd and the lead throw odd, the center line of the slot will line up with the center line of the bar; (3) with the coil throw even and the lead throw odd, the center line of the tooth will line up with the center line of the bar; (4) with the coil throw odd and the lead throw even, the center line of the slot will line up with the center line of the mica.

JOHN S. DEAN,
Motor Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

System for Inspecting Motors and Equipment

IN ORDER that inspectors of motor equipment in industrial plants may not neglect any details, it is well to issue or post directions which may serve as a reminder. The directions may be worked up in the form of instruction sheets or as a blueprint, a copy being given to each inspector.

Not only is it a good idea to be sure the inspectors are uniformly instructed as to what troubles to look for and their possible remedies, but it is also a good practice to alternate the inspectors weekly. This arrangement gives them a change of work and also allows each man the chance of discovering some possible trouble overlooked by the last inspector. The element of competition which enters through this method is helpful in insuring efficient and thorough work.

It has also been found advisable to use a trouble card containing information on the following points: motor, location, pulley, belt, base bolts, oil gages, commutator, brushes, springs, leads, temperature, line, relays, switch, and starter contacts. Space for "remarks," for the inspector's signature and for the date is provided. The inspector enters the nature of the trouble, and when it has been attended to the card is signed by the mechanic doing the work.

Another check on inspection which has been found helpful is to have tacked up near each motor a printed card with a small blank space for every day in the next three or six months. The inspector when he inspects the motor or other apparatus marks in the date on the proper square. This method gives a check on the time the inspection was made when compared with the report turned in to the electrical or other department.

One plant also requires the superintendent to make

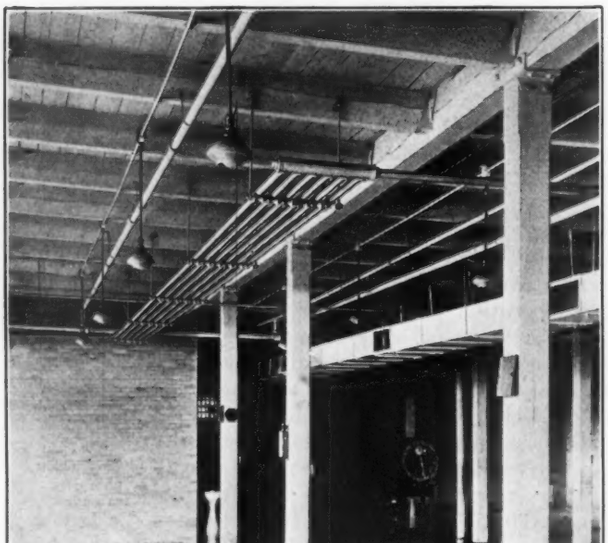
a very thorough inquiry into the cause of every motor shutdown. If the shutdown could have been avoided, or if the blame falls on the electrical department, the result is in the nature of a warning. Efficiency in inspection work simply means that the inspectors must pay careful attention to their work and see that repairs are reported promptly. There is a tendency to neglect motors that are difficult to get at, such as those suspended from a ceiling or installed in dark places. These motors are particularly the ones which should not be neglected, and a good inspector will make every effort to do thorough work, regardless of the location of the equipment. If the inspection work is done properly, there should be very few shutdowns of motors. In one large plant operating in New York State and using 125 motors, rated at from 1 hp. to 50 hp., there has been only one actual shutdown during working hours in a year's time. That particular case was due to dust in a woodshop motor getting into a bearing and stopping the oil ring and so overheating the sleeve. In almost every plant inspection will be found to pay both by the reduction of motor shutdowns during working hours and by the reduction of motor upkeep costs due to trouble with bearings. It also means a reduction of rotor and starter repairs.

H. S. RICH.

East Berlin, Conn.

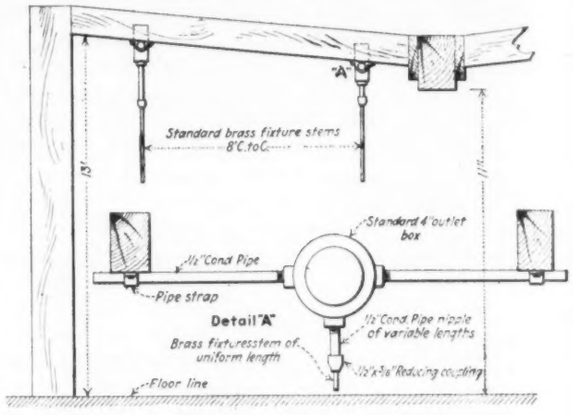
Symmetrical and Economical Factory Lighting Installation

TO PROVIDE uniform lighting in one of the sections of the Graton & Knight factory constructed during the war, and to avoid undue expense in overhead fittings, the symmetrical layout shown in the accompanying photograph was adopted. Lamps are spaced 10 ft. apart longitudinally and 8 ft. apart laterally,



GAS-FILLED 100-WATT LAMPS SPACED 8 FT. X 10 FT., 9½ FT. ABOVE FLOOR, GIVE 5.5 FT.-CANDLES ON WORKING PLANE

100-watt gas-filled incandescents of the bowl-enamel type being installed in Holophane reflector-refractors at a height of 9 ft. 6 in. above the floor. For the horizontal runs No. 14 rubber-covered wire is used, No. 16 rubber-covered wire making the drop to each unit. One-half-inch horizontal rigid conduit is employed, and the spacing adopted between lamps enabled this pipe to be installed with very little cutting on the job. On a working plane 30 in. above the floor measurements show an intensity of illumination of 5.5 ft.-candles. A mill-white paint on ceiling, walls and piping adds greatly to the efficiency of illumination.



METHOD OF HANGING LAMPS AT UNIFORM HEIGHT

A feature of this installation is the means employed in mounting the fixtures so as to bring the lamps into the same plane 9 ft. 6 in. over the floor. The location in the top story of this mill-type factory building presented a problem of fixture suspension from a beamed ceiling with a variation in elevation of about 2 ft. from walls to the center of the building, where the roof drains are. The method shown in the sketch was adopted and proved entirely satisfactory and economical in construction.

A. H. MAGNUSON,
Electrical Engineer.

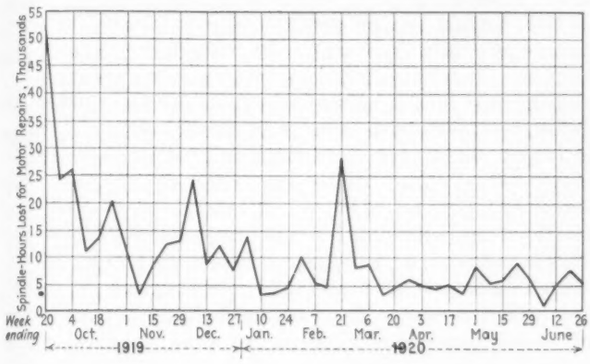
Graton & Knight Manufacturing Company,
Worcester, Mass.

Regular Motor Inspection Cuts Lost Machine-Hours 80 per Cent

CONCRETE proof of the value of systematic motor inspection is evident in the records of the Acme Wire Company, New Haven, Conn. Before regular inspection was started, in September, 1919, the average spindle-hours lost on account of motor repairs in a section of the factory amounted to 5,250 per week. About 100 direct-current motors, rated at ¾ hp., operating at 240 volts and running 1,700 r.p.m. in continuous day and night service, were involved. These motors were individually connected to machines, and for two years motors had been repaired after trouble developed, only superficial inspection being given during operation. In view of the foregoing lost time it was decided to adopt a regular inspection program planned to forestall motor failures as far as possible. The scheme was immediately effective, and as a result the lost spindle-hours due to motor troubles have been reduced 80 per cent.

Over the week-end of Sept. 20, 1919, about 25 per cent of the motors were taken out, overhauled and restored to service. In one week the lost time fell to 2,400 spindle-hours. Twenty-five per cent more were overhauled during the next week-end. The accompanying chart shows a general decrease in spindle-hours lost through the remainder of 1919 and to the spring of 1920, when a range of weekly losses running well below 750 spindle-hours was attained. The trend of the curve argues well for preventive systematic inspection.

The plan is to subject each motor to the maintenance inspection every six months. To that end motors are inspected at the rate of four a week, so that the entire lot is rotated every twenty-five weeks. The program followed is to take the motors apart, wash the field coils with gasoline, note if leads are chafed and wash with gasoline, shellac the outside of the field coils to keep oil out of the windings, examine bearings and look for stuck rings, micrometer worn shafts, wash armatures with gasoline followed by shellacking, turn down



SYSTEMATIZED INSPECTION AND OVERHAULING REDUCED LOST SPINDLE-HOURS FROM 5,250 TO BELOW 750 PER WEEK

commutator bars and undercut the mica, clean commutators, test resistance between segments and test for incipient grounds between segments, winding and frame.

Once a week, or after running for 120 hours, all motors in service are examined at close range for oiling conditions and overheating. The system of "anticipatory" maintenance described above is carried out under the direction of Mario Bozzi, electrician of the Acme Wire Company.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Satisfactory Way to Pour Bearings and Lead Grout Under Bedplates

CONSIDERABLE trouble is sometimes experienced in pouring bearings and in pouring lead grout or mat under bedplates that are supported on steel foundations. The trouble seems to be in getting the proper kind of substance to seal the joints. In a good many instances a mixture of fireclay and water is used, but when the metal comes in contact with the damp clay steam forms and causes air holes or blowouts. Mixing asbestos and oil together to about the same pliability as putty makes an excellent sealing compound which does not give this trouble.

In pouring lead grout under bedplates where the bedplate is of considerable length and the I-beams supporting the plate are from 6 in. to 8 in. in width and the mat is to be from ½ in. to ¾ in. thick, it is best to divide or partition off about every two feet. By sealing all joints of the wooden forms around the bedplate with the compound of asbestos and oil and having the lead hot enough to char a wooden stick and pouring as fast as possible very good results will be accomplished. The same idea applies to bearings or any similar part where good results are desired. R. L. JOHNSON,

Erecting Engineer.

Westinghouse Electric & Manufacturing Company, Detroit, Mich.

Adapting Alternating-Current Heater to Direct-Current Operation

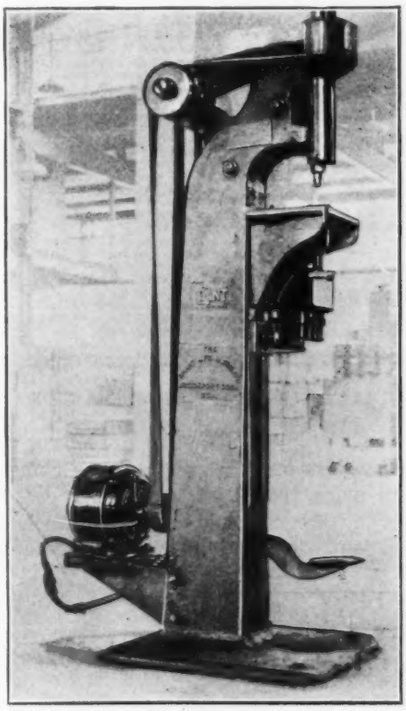
SOME trouble was experienced with the thermostat of a hot-water heater after changing over from alternating to direct current in a Pennsylvania factory. The heater, a 1,500-watt three-heat device of the immersion type, for use in an ordinary range boiler, was installed to supply hot water for the office service rooms. A thermostat in connection with the heater coils controls the water temperature by cutting the coils in or out of circuit as required.

When the distribution system, including the heater, was changed to direct current, trouble was experienced at the thermostat contacts. Severe arcing occurred at these points when a coil was switched on or off, and it became evident that the operation of the heater would not be satisfactory.

To remedy the trouble, a standard 1-mfd. telephone condenser, costing less than a dollar, was connected across each contact. The operation of the thermostatic switch was then excellent. The three condensers were placed in a small treated-wood box, completely inclosed and mounted on the wall near the heater, so as to be connected easily in the circuit. The installation is neat and serviceable and the cost was comparatively small.

Honesdale, Pa. J. W. WALSH.

Compact Motor Mounting for a Rivet-Spinning Machine



NEAT MOUNTING OF A MOTOR FOR MACHINE FORMERLY IN GROUP DRIVE

A BRACKET mounting of simple but effective design is shown in the accompanying illustration where a ½-hp. Westinghouse motor running at 1,725 r.p.m. drives a Grant rivet-spinning machine in a Massachusetts industrial plant. The bracket in this case was formed of two plates of triangular shape 6 in. high and 2⅝ in. thick attached to the machine pedestal by ½-in. bolts. This bracket keeps the motor off the floor, thus preventing it from accumulating dirt and also allowing cleaning underneath. The long vertical drive gives very satisfactory service. The starting switch is mounted on the frame of the machine at a convenient height near the operator's right hand.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

War Prices of Commodities Compared with Utility Rates

TO SHOW that the utility companies did not benefit from high prices or war rates, the Arkansas Light & Power Company of Pine Bluff, Ark., recently published the accompanying advertisement in several cities

COSTS IN 1913 and 1921

Prices of Some Things Are Lower Than 1919

—But see where they went to before they began to descend. And yet—

—Most everything is still above 1913 prices.

READ THIS

See information published by National Bank of Commerce of New York City.

RATES FOR ELECTRICITY AND WATER WERE NOT ADVANCED

—until long after labor, fuel and other costs had greatly increased. Even then the advance was insufficient to meet the greater costs. Under these circumstances it cannot be expected that rates for electricity and water can be reduced as quickly as prices of commodities which doubled, even quadrupled, in price, and are still far above pre-war prices.

ARKANSAS LIGHT & POWER COMPANY

COSTS IN 1913 AND 1921

The Commerce Monthly for July issued by the National Bank of Commerce of New York, has a listed schedule of wholesale prices. It shows that farm products were about as low as they were in 1913.

Cattle in January, 1913, were $7.-85. The reached their highest in October 1919, when they were $16.-80. In June, 1921, cattle were $7.-95.

West Virginia coal in 1913 was $1.35 a gross ton. It ran to $12 in July. It now is $2.20.

Corn in Chicago was 50 cent in 1913. It reached $1.92 in July 1919 and now is 61 cents.

Middling spot cotton was $12.50 in January 1915. It rose to $41.50 on the New Orleans market in April 1920. It now is $11.25 in the New Orleans market.

Hides were 18 cents in 1913. They went to 52 cents in July 1919. They are 14 cents now.

No. 1 calf skins were 19 cents in 1913. They were 90 cents in 1919. Now they are 18 cents.

Hogs were $7.40 in 1913. They were $22.20 in July, 1919. Now they are $7.95.

Steel billets were $29 a ton in 1913 They rose to $65 a ton in 1920. Now they are $37 a ton.

Kansas-Oklahoma petroleum was 83 cents a barrel in 1913. It was $3.50 a barrel in October, 1920. Now it is $1.25 a barrel.

Winter wheat was $1.11 in 1913. It fell to 78 cents in July, 1914. It advanced in October of the same year. It was $2.85 in July, 1920. Now it is about $1.40.

Fine Ohio wool in 1913 was 72 cents. It rose to $2.35 in April, 1920. Now it is 85 cents.

PUBLICITY SHOWING THAT UTILITY RATES HAVE NOT BEEN WAR-INFLATED

where it operates. It points out that while many commodities increased in price from 100 to 300 per cent above pre-war levels, utility rates in many instances did not advance sufficiently even to meet the greater operating costs.

Central Maine Adopts New Plan for Employee Stock Selling

THE Central Maine Power Company has adopted a new plan for employee stock selling which will do away with the former short-period contests and place this work on a par with other phases of the company's business. Under the new arrangement the sale of stock by employees will become a steady, year-around performance, with a closing date every six months. District and department quotas will be figured on a weekly basis, and all districts and departments will be urged to sell their quota each week. The quotas assigned will be definite and carry definite responsibilities to each department and division head. Higher commissions have also been established as follows: For the first ten shares sold, $1 per share; for the next ten, $1.25 per share; for the next ten, $1.50 a share; for the next ten, $1.75 per share, and for all above forty shares, $2 per share. A so-called supercommission of 25 cents per share will also be added on all shares sold above the quota of any district. These extra commissions are established in lieu of the many weekly prizes previously offered but now discontinued. Five prizes, however, will still be awarded for various district, departmental and individual championships. A total quota of 3,000 shares sold by employees has been established for the period ending Jan. 21, 1922.

Power Factor in Electric Power Rates

By H. W. Meyer
Northern States Power Company, Minneapolis

THE power factor of the energy taken by a power consumer should in some way be a factor in the rate which a consumer pays for energy taken from the lines of a public service company. Where the power factor is less than unity there is an increase in the capacity of transformers, lines, cables, substations and generating capacity required. Copper losses are increased and voltage regulation is made more difficult. If hydraulic plants are operated on the system, there is a direct loss in the kilowatt-hours which may be generated due to the limitation of the output of the generators because of heating. Such a loss, of course, exists only when there is ample water for operating at full load and where the hydro-electric plant capacity is not sufficient to carry the entire load.

It has been proposed to install watt-hour meters so connected as to read the reactive component of the kilowatt-ampere-hours and from this reading and the reading of the ordinary watt-hour meter calculate a power factor which forms the basis of a penalty or a factor to be applied to the power rate.

Some Methods Undesirable

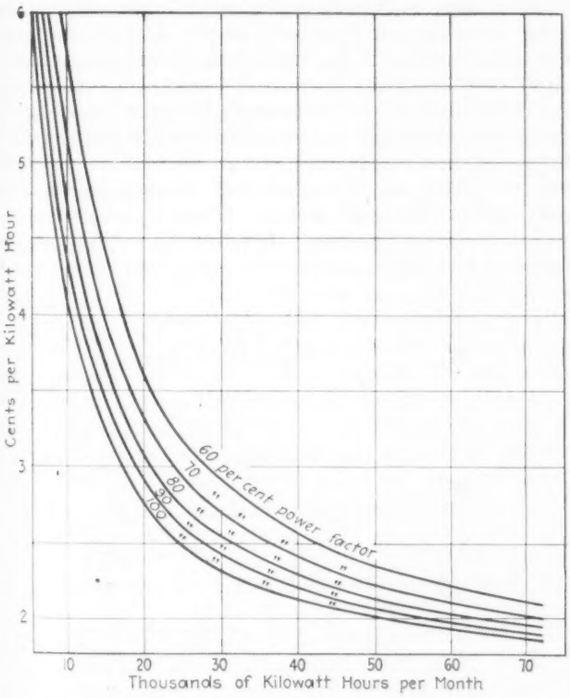
This scheme will, of course, give the consumer with a low power factor an incentive to increase that power factor, but it has certain objections. The power factor which is calculated by this method is not an average power factor, as has been stated. This is true for the reason that the reactive component increases very rapidly as the power factor becomes low. Two consumers may therefore, if the reactive component meter is used, have the same number of kilowatt-hours during a month and the same number of reactive kilowatt-ampere-hours and yet have widely different characteristic loads, one of which may be desirable from the point of view of the central-station company

and the other undesirable because of poor power factor at the time of maximum demand.

This method of penalizing for low power factors has the further objection that it involves a formula which is not generally understood by the consumers and is subject to errors in calculation. Any rate in which a penalty is provided based on the per cent power factor is objectionable and to be avoided if possible.

For these reasons a different method of taking into account a consumer's power factor is here proposed which consists of measuring the maximum kilovolt-ampere demand made by the consumer and using this demand in a demand-energy rate in place of the maximum kilowatt demand.

Such a rate is logical inasmuch as the consumer is required to pay fixed charges on the equipment which he makes necessary, plus an energy charge to cover the



RATES PER KILOWATT-HOUR BASED ON DEMAND ENERGY SCHEDULE FOR LOAD OF 100 KW. AT VARIOUS POWER FACTORS

operating costs in producing the kilowatt-hours consumed.

The objection may be raised that certain consumers will have high power factors over their maximum loads and may have low power factors at light loads. This is, of course, true of certain power consumers using induction motors which are only lightly loaded at times and fully loaded at other times; but the objection is not serious since the most vital factor from the central station company's point of view is the maximum kilovolt-ampere demand, especially if this occurs on the system peak.

A rate of this kind involves no objectionable changes in existing demand-energy rates and at the same time offers an incentive to the consumer to increase his power factor.

The accompanying curves show the rate per kilowatt-hour for consumers having a 100-kw. energy demand and various kilowatt-hour consumptions per month with different power factors. These curves are based on a demand-energy rate of $30 per kilovolt-ampere of maximum demand per year plus 1.5 cents per kilowatt-hour. The 100 per cent power-factor curve is, of course, the same as the rate which would be charged if the demand charge were based on kilowatts of maximum demand instead of kilovolt-amperes.

In order to apply such a rate at this time, it would be necessary to install a recording ammeter and a recording voltmeter to determine the maximum kilovolt-amperes for the month, as there is as yet no instrument which will measure directly the kilovolt-amperes in a circuit. Such an instrument can no doubt be devised and would be highly desirable in connection with a rate of the kind which is proposed.

From Here and There

Boston, Mass.—An innovation in the good work of the Edison employees' loyalty committee of the Edison Electric Illuminating Company was a series of five-minute talks to employees during business hours. The talks were arranged in all locations where there were ten to twelve employees, and a definite schedule was announced. Thirty five-minute talks on "Good-Will" and "Loyalty" were given recently in four days. The speakers were James White, chairman of the Edison employees' loyalty committeee, and Harry A. Townes of the employment bureau.

Ogden, Utah.—Employees of the Utah Power & Light Company who have occasion to visit homes in connection with their work have been equipped with badges, which carry the company name, number assigned to the employee, and the department to which the employee belongs. This action has been taken to safeguard Ogden residents against possible theft by persons who have resorted to the strategy of saying that they were light or gas meter inspectors. Residents of the city have been warned by the company to allow no person to enter their homes to read light or gas meters unless he can show one of these badges. Employees of the Salt Lake office of the company have been similarly equipped for some time.

New York.—The Cities Service Company presents the interesting fact of an expanding list of stockholders despite the depressed condition of the general securities market. As of Aug. 15, when the books closed for the dividends payable Sept. 1, there were 60,426 holders of record of the Cities Service Company stocks, comparing with 57,492 stockholders of record of May 15, the date of closing books for the June 1 dividend. On Aug. 15 there were 8,327 holders of the company's common stock, 22,535 holders of its bankers' shares, 24,680 holders of preferred stock and 4,884 holders of preference B stock, these figures comparing with 7,935 holders of common stock, 20,299 holders of bankers' shares, 24,507 holders of preferred stock and 4,753 holders of preference B stock on May 15, the increase in the total number of stockholders from May 15 to Aug. 15 being 2,935. These figures do not include any of the holders of debentures or of securities of subsidiary companies, and should these be included the total number of holders of securities of Cities Service Company and subsidiaries would be in excess of 100,000.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generation, Transmission and Distribution

Induction and Self-Inductance of a Straight Transmission Line with Earth Return and the Potential Difference on the Earth Surface.—With the assumptions that the earth has a uniform specific resistance and that the stream lines of current of commercial frequencies in it may be taken approximately as those determined with resistance only taken into account, it is shown that the emf. induced by a varying current in a straight transmission line with earth return, in a conductor 1 cm. long parallel to the line at a point p distant y_o cm. from the line, may be expressed by

$$-\left(\log \frac{y_o}{\sqrt{x^2+y_o^2}-x}+\log \frac{y_o}{\sqrt{z^2+y^2}-z}\right)\frac{di}{dt},$$

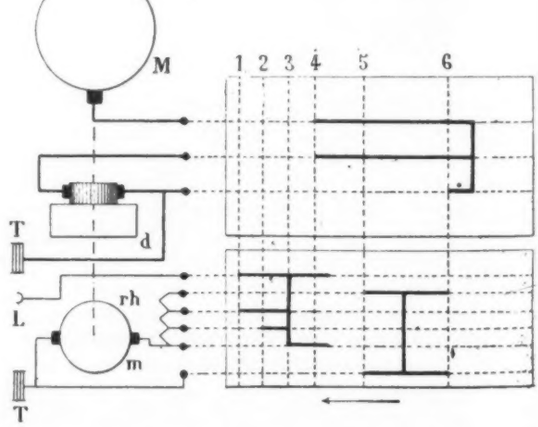
x and z being the distances from the two ends of the line to the foot of the perpendicular from p to the line. x or z is to be taken negative when p is outside the line in either direction. Integrating this, the total emf. induced in a parallel line is obtained. As a result of application of the formula, the self-inductance of a single-conductor straight transmission line with earth return is shown to be

$$L = 2D\left(\log \frac{2D}{r}-\frac{3}{4}\right)$$

where D is the length of the line and r is the radius of the conductor. Lastly, the potential difference on earth surface is expressed in terms of the electrostatic capacities of the electrodes.—*Journal Institute of Electrical Engineers of Japan*, July 10, 1921.

Traction

Inductive Starter for Direct-Current Railway Motors.—A. GIVELET.—The use of ohmic resistance during the starting period of direct-current railway motors is, as is generally known, a great waste. Millions of kilowatt-hours are wasted annually in the resistance starters of all direct-current motor-driven vehicles. The author has developed a radically new method for starting direct-current motors which is both very simple and very effective and does away entirely with wasteful ohmic resistance. The principle of the new method may be explained thus: Suppose an annular "Gramme" armature with a commutator and two brushes arranged at opposite sides. To close the magnetic circuit two poles embrace the armature and are connected by the customary yoke of laminated iron. Standing still, this arrangement will give virtually zero resistance to any current passing through it. If, however, this armature is revolved at the time the direct current passes through it, the resistance will increase proportionally with the speed until a point is reached where further speeding up results in no higher resistance. The induction and the speed vary, therefore, in inverse proportion, so that their product stays constant and equal to the line voltage. ($e = iLw$, $w = 2\pi n$). From this it is apparent that such an apparatus may be used advantageously instead of ohmic resistance for the starting of any direct-current motor. For practical use a drum armature inclosing two windings is used, every turn of one winding being connected to the even commutator bars and every turn of the second winding being connected to the odd bars. A pair of high-resistance brushes somewhat wider than one commutator bar connect the lines to the armature. Surrounding the armature is a laminated stator carrying no windings. This apparatus is driven by a small auxiliary motor, requiring only such an amount of power as to overcome friction. The first two notches on the controller start the small motor. When this small motor has attained full speed and therefore offers the greatest degree of resistance against any passing direct current,



MOTOR AND CONTROL CIRCUITS FOR AUTOMATIC INDUCTION STARTER FOR DIRECT-CURRENT MOTOR

the small motor is taken off the line and the main motor is laid directly on the line, with the spinning armature of the induction resistance in series. As this armature slows down its resistance becomes less and less, which in turn causes the main motor to start up to speed. By the time the armature stands still the main motor is up to full speed and the starting armature may be short-circuited. If necessary, the auxiliary motor may be slowed down in less time by short-circuting its terminals across a resistor (see diagram of circuits). If, as is the case with most motor cars, two main motors are used in series-parallel arrangement, one small auxiliary motor may drive two inductive-resistance armatures. In this case the small motor is started up and slowed down twice, first for starting the

group of two main motors in series and a second time to put them on the line in parallel. The inventor claims: (1) The auxiliary motor may run very much faster than the main motor—for example, at 3,000 r.p.m. as against 600 r.p.m.—and as the armature windings of the inductive resistor carry current only for a very brief period, a very high current and iron density may be used. In no case should the volume of the inductance be more than one-eighth to one-sixth of the volume of the armature of the main motor. (2) It requires a very small driving energy. (3) The method always permits uniform and automatic starting. (4) The starting is stepless and therefore smooth. (5) Cable connections between the controller and the motor or motors are very much simplified.—*Revue Générale de l'Electricité*, July 23, 1921.

Installations, Systems and Appliances

Electrical Cleaning of Blast-Furnace Gases.—N. H. GELLERT.—In showing why present methods fall short of the desired results the author points out how the electrical screen does its duty. The method employed is that developed by Dr. F. G. Cottrell several years ago. The problem in electrical precipitation, the author maintains, is to regulate the vertical and horizontal forces sufficiently to form a resultant which will precipitate the particle of dust on the side of the pipe. The vertical force can be regulated by the cross-sectional area of the pipe. It has been erroneously assumed that the bigger the pipe and the greater the voltage that may be impressed, the stronger the force that may be secured to act horizontally. This is not true because the force varies inversely as the square of the distance between the object to be precipitated and the electrode, so that even with higher voltage the impressed force on the particles may be less than with lower voltage. Features of some of the equipment used for the electric precipitation are described. At Sheridan and Dunbar the results obtained with electric precipitation are very satisfactory, the precipitator collecting approximately 5,000 lb. of dust per day, from the output of a 250-ton furnace. With the plant operating on pig iron instead of ferromanganese, the indications were that the precipitator could clean ordinary gases to less than 0.1 grain.—*Iron Age*, Aug. 11, 1921.

Electrophysics and Magnetism

The Laws of Absorption of X-Rays.—F. K. RICHTMYER.—In these experiments homogeneous radiation was insured by using a Bragg spectrometer, and the effects of secondary radiation were avoided by placing the absorbing material between the two slits which limited the beam. By taking these and other precautions a precision of 0.5 per cent was obtained. It is pointed out that the linear relation established by Hull and Rice between the mass-absorption coefficient and the wave length holds accurately for silver, aluminum, copper, molybdenum, lead and water until as the wave length is increased the characteristic K limit is approached. The linear relation also holds above the K limit, but the mass-scattering coefficient is about the same. The atomic absorption coefficient for wave lengths below K is a linear function of N^4, where N is the atomic number. The general law of X-ray absorption is therefore $\mu_a = kN^4\lambda^3 + \sigma_a$, where k is a universal constant equal to 2.29×10^{-27} below the K limit and to 0.33×10^{-27} above that limit.—*Physical Review*, July, 1921.

Thermal, Electrical and Magnetic Properties of Alloys.—ALPHEUS W. SMITH.—The author considers about thirty alloys and shows the variations in freezing point, thermo-electromotive force, electrical conductivity, magnetic susceptibility and other values with change in percentage of constituents. In the discussion of the results, principal attention is paid to the change of thermo-electromotive force with temperature, the theories of resistance and thermo-electromotive forces, and resistance and hardness.—*Journal Franklin Institute*, August, 1921.

Electrochemistry and Batteries

Effect of Temperature and Humidity on the Capacity of Inert Cells.—C. LAWTON.—From tests carried out in Calcutta, India, the author concludes that both the temperature and humidity affect the capacity of inert cells.—*Post Office Electrical Engineers' Journal*, July, 1921.

Units, Measurements and Instruments

Harmonic Analysis by Selected Ordinates.—ALBERT E. CLAYTON.—The accuracy of the original Perry method and some of its simplifications is investigated. It is shown that such methods are theoretically exact, provided that the number of ordinates chosen per half period is greater than the order of the highest harmonic present. The third part of the paper gives a brief review of three other methods of practical analysis of wave forms, namely, Wedmore's, Fischer-Hinnen's and Thompson's, and Russell's method of applying Weddle's rule to the determination of the values of the various Fourier integrals.—*Journal Institution Electrical Engineers* (London), Vol. 59, No. 301.

Telegraphy, Telephony and Signals

Digest of United States Patents Relating to Radio.—JOHN B. BRADY.—This section makes available in convenient form for research engineers and others interested brief information on radio patents which are issued each week by the Patent Office.—*Proceedings Institute Radio Engineers*, August, 1921.

Imperial Wireless Station at Leafield, Oxfordshire.—E. H. SHAUGHNESSY.—Description of the 500-kw. installation, using Elwell arc machines. For signaling, a spacing wave is used; that is, during the spaces between the Morse signals energy continues to be radiated, but at a wave length differing from that used for the marks. The change of wave length is effected by varying the inductance of the keying inductance.—*Post Office Electrical Engineers' Journal*, July, 1921.

Miscellaneous

Curves That Show Comparisons of Electric Machines.—J. BLONSTEIN.—The use of cross-section paper ruled horizontally and vertically on a logarithmic scale may be useful in the comparison of different sizes of electric machines by plotting such data as are contained in the catalogs of manufacturers. When the weights and prices of the machines are plotted on the diagram as functions of the output, it is possible to see at a glance any irregularities of the design series. This method also permits of fairly safe interpolation and extrapolation of new sizes. Among the advantages in using logarithmic scales instead of rectilinear scales the author mentions the shorter length of the first-mentioned scale and the fact that the weights will give a straight line if expressed as a function of the output.—*Revue Générale de l'Electricité*, July 16, 1921.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

INSULATION, LEAKAGE IN.

An experimental investigation is being made of the losses in various types of insulation under alternating potentials. An electrostatic wattmeter is used for potentials up to 25,000 volts. —*J. B. Whitehead, Johns Hopkins University, Baltimore, Md.*

VIBRATIONS OF MACHINERY, MEASUREMENT OF.

A "vibrascope" has been devised to indicate the amplitude of the vibrations of machinery in operation. The frame of the instrument is attached to the machine under test, and the amplitude of vibration may then be read on the instrument scale.—*Prime Movers Committee, N. E. L. A.*

ELECTROSTATIC MEASUREMENTS, COMPENSATION SCHEME FOR.

In the measurement of an ionic saturation current in a gas it is customary to connect one plate of the ionization chamber to one pole of a high-potential battery, the other plate being connected to one quadrant of an electrometer whose other quadrant, together with the remaining pole of the battery, is connected to the electrometer case. If under these conditions the electrometer is to be free from fluctuations resulting from the inductive action of the high-potential plate, a very high battery constancy is essential. The difficulties arising from fluctuations in the battery potential may be eliminated by the following simple device: A high-potential battery is connected to the ends of a high resistance. The high potential plate of the ionization chamber, the electrometer needle, electrometer case and the outer member of an auxiliary condenser are connected respectively to different points along the resistance. Thus the ionization chamber potential and the needle potential are provided from the same battery. It is readily possible so to adjust the conditions that there will be no inductive deflection of the needle on throwing on the entire battery.—*W. F. G. Swann, Minneapolis, Minn.*

GROUND DETECTORS.

Some experiments are under way to develop a detector for 2,200-volt service which will have the necessary sensitiveness and yet avoid the defects of the present types. A three-phase differential relay has been made for connection direct to the secondaries of a potential transformer. Tests have proved that this relay is just as sensitive as one in the primary ground. Experiments have also been made with what might be called a "three-phase, differential, hot-wire ammeter" to replace the indicating lamps. Although these experiments have not been carried very far as yet, it is believed this device can be brought to such a point that its combination with the differential relay will make a ground detector which will be both safe and reliable.—*Accident Prevention Committee, N. E. L. A.*

IMPEDANCE MEASUREMENTS WITH HUND'S DIFFERENTIAL TRANSFORMER.

Hund's method (ELECTRICAL WORLD, Vol. 65, page 1,800) was successfully applied to the measurement of the effective resistance and inductance of telephone lines and induction coils at frequencies of $2\pi f = 10{,}000$. A common duplex telephone coil was used as a differential transformer and the secondary was connected to a telephone receiver. The unknown resistance and inductance were balanced on the primary side against standard values until the noise in the receiver disappeared. With this method a simple supervision of long-distance telephone circuits is possible, using the traffic current itself for measurements.—*Bela Gati, Budapest, Hungary.*

CONVERTER, ROTARY, SINGLE-PHASE.

In an ideal single-phase converter, disregarding the moment of inertia of the armature, the instantaneous power on the alternating-current side and on the direct-current side must be equal to each other. But the alternating-current power is fluctuating, so that the direct-current power and the speed of the machine must also fluctuate within wide limits. In a real machine these theoretical relations are essentially modified and the direct-current power flow is made more uniform owing to the inertia of the revolving part, magnetic energy stored in the inductance of the windings and because of the losses in the machine. An oscillographic study was made of a small single-phase rotary converter, running it both from the direct-current and from the alternating-current side, and the records substantiate the above mentioned theoretical conclusions; namely, that the direct-current power and amperage are fluctuating and that the machine cannot be made to run without appreciable hunting.—*M. Morrison, New York City.*

GLASS, OPTICAL, ANNEALED IN ELECTRIC FURNACE.

Considerable difficulty has been experienced with the manufacture of large glass disks for optical lenses in gas-fired furnaces. Disks 20 in. in diameter were broken by too rapid cooling during a gas shortage. A special electric furnace was therefore built for annealing and slowly cooling glass disks. The temperature of a 22-in. disk was kept constant for eleven days, and then cooling was begun at a rate of less than 0.5 deg. Fahr. per hour. The rate of cooling was controlled by automatic electric devices and continued for five weeks. Power interruptions lasting a few minutes occurred several times but caused no mishap. With this electric furnace it is expected that disks up to 40 in. in diameter can be successfully made.—*Spencer Lens Company, Hamburg, N. Y.*

PAPER, PHYSICAL AND CHEMICAL TESTING OF.

A large number of tests have been made in a special room maintained at a constant temperature of 21 deg. C. and 65 per cent relative humidity. Methods have been developed for determining the percentage of ash and the amount of sizing, also qualitative and quantitative tests for rosin in paper and for the various kinds of loading materials. — *Bureau of Standards, Washington, D. C.*

[The results of this research may be of interest to electrical manufacturers who use paper for insulation.—EDITORS.]

Suggestions for Research

FUEL, LOW-GRADE, ADAPTATION OF STOKERS TO.

It would be of great general interest if qualified persons of experience would publish results of investigation made to determine how existing stokers can be made to burn low-grade fuels without clinker trouble, high maintenance expense, loss in efficiency or too big a loss in rating.—*Editorial Suggestion.*

EXPLOSIONS ON SHORT CIRCUIT.

The committee urgently recommends that more study be given to the design and installation of current-limiting reactances, circuit breakers, instrument transformers and protective devices, and also that ample clearances be allowed not only in new installations, but also on older installations before interconnection with systems of large capacity is made.—*Accident Prevention Committee, N. E. L. A.*

POWER PLANTS, STEAM, EXTRA-HIGH-PRESSURE.

In order to test the possibilities of steam-power units of extra high pressure at the least possible cost, a small high-pressure turbine should be installed in an existing power station which would reduce high-pressure steam to the ordinary pressure used in the plant and discharge it into the plant mains. Such an installation could be fed from a small high-pressure steam generator at low cost, and its performance record would give some idea of the advisability of spending money and effort in the further development of high-pressure units.—*Prime Movers Committee, N. E. L. A.*

ACOUSTIC SHOCK PREVENTION.

One of the troubles resulting from inductive interference at times of certain faults on parallel power lines is the acoustic shock which is sometimes given to the telephone operator on account of the snapping of the diaphragms of the receiver. The present telephone protector gap consists of a pair of carbon blocks separated by a mica spacer with a hole or slot in it. This gap is connected between the telephone line and the ground, and in case of high induced voltage it breaks over and relieves the strain on the telephone apparatus. Acoustic shock is liable to occur when this gap breaks down on account of the flow of current from the side of the line which does not ground through the receiver to the side which is grounded by the gap. It has been proposed that gaps be made so that they will insure that both sides of the circuit are grounded at precisely the same instant, and further investigation is desired in this direction, and also by means of an air column between the diaphragm and the operator's ear.—*Inductive Interference Committee, N. E. L. A.*

VACUUM TUBE APPLICATIONS.

The perfection of vacuum-tube amplifiers for use in place of electrostatic voltmeters, and for use with oscillographs for recording without disturbance of circuit.—*F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology, Cambridge, Mass.*

GROUND DETECTORS.

It has been found that a very dangerous hazard may result from high-voltage wires becoming grounded or crossed with other wires under conditions which cause no disturbance on the circuit and which may thus remain undiscovered for some time. Several cases have occurred which resulted in loss of life or in personal property damage which could have been avoided if the circuit involved had been equipped with a reliable, sensitive ground detector. A ground detector which would indicate even very high-resistance grounds and would sound an alarm as soon as such a ground occurred is very essential to safe operation. The static ground indicator is not sensitive enough and has no alarm feature. There seemed to be no other available, so the detector was developed shown on page 14 of committee's 1921 report. This detector has several defects and its further development is recommended.—*Accident Prevention Committee, N. E. L. A.*

TUBES, CONDENSER, CORROSION OF.

Experience has indicated that the microstructure of the metal in condenser tubes has a great influence upon the resistance of the tube to corrosion. It would be of great advantage to users of condenser tubes if some simple physical test could be applied to all tubes to indicate their fitness as regards microstructure. An actual microscopic study takes too long and is too expensive. —*N. E. L. A. Prime Movers Committee.*

PETERSEN EARTH COIL FOR POWER CIRCUITS.

This device has been described in the foreign technical press by W. Petersen of Darmstadt and has been used on a few lines in Germany and Switzerland. It consists of a reactance coil which is connected between the neutral point of star-connected transformers and ground and is of such dimensions as to be resonant to the capacity of the transmission conductors to ground at the normal frequency of the circuit. It is claimed that such an arrangement eliminates oscillatory discharge from arcing grounds and limits the flow of fault current to a relatively small quantity. A careful detailed investigation of this method is desired.—*Inductive Interference Committee of the N. E. L. A.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

New York Utilities May Issue No-Par-Value Stock

ATTENTION of all dealers in and holders of public utility securities is called by H. M. Addinsell, chairman of the public service securities committee of the Investment Bankers' Association of America, in an interim report, to the recent amendment to New York State "no-par-value" law extending the privilege of issuing stock of no par value to public utility corporations. After quoting S. Z. Mitchell, president Electric Bond & Share Company, and O. B. Wilcox, past-chairman of the committee, favoring no par value for public utility stocks, the report says:

"The first state actually to embody this idea in a law was New York, which passed the act authorizing the organization of corporations having shares without par value in 1912. Since any new legislative ideas taken up by the conservative Empire State always attract much attention throughout the country, the following years saw many other states adopt similar measures. During the various protracted discussions relative to this subject the idea had been expanded and developed to such a degree that the New York law of 1912 had become somewhat obsolete, and this new amendment was needed to bring it up to date.

Irrigationists Win in Deschutes River Conflict

THAT no license be issued for water-power development on either the Upper or the Lower Deschutes River in Oregon which is not in harmony with the maximum development of irrigation is the recommendation of the board of engineers that investigated the use of this river and its tributaries as the result of a conflict between irrigation and power interests. Three filings were made for power on the river—one by the Columbia Valley Power Company for 78,000 hp. and two by H. S. McGowan totaling 131,000 hp.

Considerable interest has attached to this investigation because it is the first case of conflict between power and irrigation to be decided by the Federal Power Commission. There are other conflicts of somewhat similar nature as yet undecided, the most important of which relates to the Colorado River development.

The board of engineers was composed of D. C. Henney, consulting engineer of the Reclamation Service (chairman); Col. J. B. Cavanaugh, Corps of Engineers, U. S. Army, the division engineer for the Northwest district, and Fred Henshaw, the Geological Survey's district engineer for the Northwest. The report, which was made to the Federal Power Commission, is voluminous, covering more than 300 typewritten pages. A number of recommendations are made, among which are the following:

That storage rights in the Upper Deschutes be held for irrigation and domestic use.

That storage rights in the Upper Crooked River be withdrawn for best future use, it being the present opinion that use for power with incidental use for irrigation will prove most beneficial.

That, because of absence of any large market for Deschutes power and of doubt that any of the large powers in the lower river can be developed profitably within the time contemplated by law after application for preliminary permit, all such applications at this time be considered as covering necessary investigations only and be handled by the commission so that ultimate development may not be hindered when conditions under such development are economically practicable.

That no license be issued for power on either the upper or the lower river which is not in harmony with the maximum development of irrigation.

That no license be issued for any project in the lower river which is not in harmony with the general scheme for the development of water power outlined in Water Supply Paper 344 of the Geological Survey unless conclusive showing of an improvement upon this general scheme is made.

If all the Upper Deschutes be given over to irrigation, about 555,000 hp. can be developed in the lower river without storage at Post, of which 362,000 hp. is likely to be obtainable, the report states, at reasonable cost. Post storage will add 26,000 hp. On the Metolius River it is estimated that 63,000 hp. of the 88,000 hp. possible can be developed at reasonable cost.

Stability of Utilities Emphasized at New England Convention

HEALTHY growth of the central-station industry coupled with improved technique in electrical practice and increased cordiality in public relations, as well as in relations between companies and between industries, were dwelt upon at the thirteenth annual convention of the New England Geographic Division of the National Electric Light Association, held at the Hotel Griswold, New London, Conn., Sept. 7-9. In his opening address President Bowen Tufts emphasized the stability of the utility industry and urged more frequent divisional meetings and intensive economic activities by committees.

M. H. Aylesworth, executive manager N. E. L. A., commended the progress of the inductive interference and public policy work of the national body, and Frank W. Smith, first vice-president, greeted the convention in the absence of President M. R. Bump. Vincent Goldthwaite, Boston, described the work of the purchasing agents' committee, which has already saved the divisional subscribers considerable money through comparisons of fuel and supply prices. A fine lecture and demonstration of the prone-pressure method of resuscitation by Dr. E. W. Bullock of the New England Telephone & Telegraph Company closed the opening session.

An Accounting Section headquarters, with exhibits and crowded informal sessions daily, in addition to the regular session, was a new departure of the convention. A budget system for construction expenditures was

recommended by the sub-committee on accounting for construction work. An exhaustive report upon purchasing and storerooom accounting was presented by W. F. Stevens, Boston, indicating lines of improved practice, and in a long discussion methods of minimizing investment and views of handling depreciation received attention.

The admirable results of customer ownership were set forth by P. H. Whiting, Central Maine Power Company, and by Mr. Aylesworth at a public relations session Wednesday evening. Among the other speakers were Joseph B. Groce, newly appointed director of the New England Bureau of Public Service Information, and George C. Gardner, vice-president Union Trust Company, Providence, R. I.

Commercial problems provided a full program on Thursday. William C. L. Eglin, chief engineer Philadelphia Electric Company, addressed the convention upon "Power-Factor Correction," emphasizing the need of planning for the future in developing distributing systems along unified lines. The speaker said that it is hoped to standardize static-condenser sectional construction for application to individual induction motors through the co-operation of the association and the manufacturers. It was the general opinion in the discussion that the customer should finance improvements that offer him a chance to realize a lower rate.

POWER-FACTOR RATES FAVORED

J. E. Gray, for the rate committee, reported in favor of power-factor clauses in rate schedules—effective at present only in the case of the larger power consumers and upon the service-charge portion of the rate.

F. A. Gallagher, Jr., Providence, R. I., presented the report of the lighting committee. Julius Daniels, Boston, spoke of the widespread interest in the Bureau for Better Illumination exhibit now maintained in that city. Increased sales of lighting equipment have already resulted. A long and enthusiastic discussion of electric range problems, with an address by P. L. Miles, Edison Electric Appliance Company, Chicago, and a demonstration by Frank J. Allen, Westinghouse Electric & Manufacturing Company, Boston, were features of the afternoon session. L. D. Gibbs, chairman electrical page committee, outlined recent efforts of the Boston Edison company to come into closer relations with contractor-dealers.

A comprehensive technical program under L. L. Elden, chairman, covering inductive interference, safety rules, electrical apparatus, plant and equipment developments, was carried through on Friday. Extracts from these papers and reports will be presented in later issues. A feature of the day was an illustrated talk by Prof. W. L. Robb, Rensselaer Polytechnic Institute, Troy, N. Y., upon "Power Development Possibilities in Connecticut." In these sessions gratifying harmony was apparent between central-station company, telephone and telegraph representatives working upon the problems of inductive interference. Revision of certain safety rules of the Bureau of Standards was advocated, and great interest was shown in the development of automatic hydro-electric plants and substations. Radio-telephone communication between central stations and line crews was declared practicable, and the possibility of operating turbo-generators with less cooling was emphasized. Advanced practice in underground distribution, including the more accurate location of faults in fresh-water cables, was also discussed.

The following officers were elected: President, Charles L. Edgar, Boston; vice-president, E. H. Barrows, Providence; secretary, Miss O. A. Bursiel, Boston; treasurer, C. R. Hayes, Boston. The executive committee members will be E. M. Graham, Bangor, Me.; F. A. Belden, Portsmouth, N. H.; D. W. Jardine, Burlington, Vt.; T. C. Fales, Boston; E. L. Milliken, Pawtucket, R. I.; Samuel Ferguson, Hartford, Conn.; A. B. Reynders, Springfield, Mass.; R. H. Rice, Lynn, Mass.; F. S. Price, George B. Quinby and Bowen Tufts, Boston.

National Safety Council Expects Large Attendance

MEN and women interested in the promotion of safety are expected to attend to the number of three or four thousand the tenth annual congress of the National Safety Council, to be held in the Massachusetts State House, Boston, on Sept. 26 to Sept. 30. As has been the custom at past safety congresses, the delegates from the various industries will meet in separate sectional meetings with others of their group to discuss the special problems of their own industries. In addition there will be general meetings in which the representatives of all industries will join. Herman Spoehrer, secretary-treasurer of the Union Electric Light & Power Company, St. Louis, will present the report of the committee on public utilities at the meeting of the public safety section, and at the meeting of the public utilities section addresses will be made as follows:

"The Necessity of the Support of Executives in Accident Prevention Work," by Charles B. Scott, general manager Bureau of Safety, Chicago (discussion by H. C. Lucas, treasurer Philadelphia Electric Company, and R. E. McDougall, manager New York & Harlem Railroad Company.)

"Hazards in Hydro-Electric Plants," by Alexander E. Bauhan, superintendent of stations Pennsylvania Water & Power Company, Baltimore (discussion by W. H. Mulligan, Hydro-Electric Power Commission of Ontario, and John Morse, general superintendent Shawinigan Water & Power Company, Montreal.)

"Risks in Handling and Storing Coal, Oil and By-products," by C. E. Paige, manager Worcester (Mass.) Gas Light Company (discussion by A. O. Mitchell, Northern Indiana Gas & Electric Company, Hammond, Ind., and James B. Douglas, United Gas Improvement Company, Philadelphia.)

"Care in the Construction and Maintenance of Overhead Lines," by A. B. Gates, superintendent of overhead lines Commonwealth Edison Company, Chicago (discussion by H. J. Burton, Consumers' Power Company, Jackson, Mich., and Charles Durfee, Rochester (N. Y.) Gas & Electric Corporation.)

"The Use of Protective Devices," by Wills Maclachlan, consulting engineer, Toronto (discussion by E. R. Dobbin, Empire Gas & Electric Company, Geneva, N. Y., and George R. Rinke, Utilities Mutual Insurance Company, New York City.)

A "get-together luncheon" of the public utilities section will be held on Tuesday, Sept. 27, at 1 o'clock at the Boston City Club. C. L. Edgar, president Edison Electric Illuminating Company, Boston; Milan R. Bump, president National Electric Light Association; William McClellan, president American Institute of Electrical Engineers, and Joseph B. McCall, president Philadelphia Electric Company, Philadelphia, will speak.

At a joint meeting of manufacturing sections "Better Industrial Lighting" will be the topic—"Why?" being answered by R. W. Shenton, National Lamp Works, Cleveland, and "How?" by A. S. Turner, Edison Lamp Works, Harrison, N. J.

Southeastern Drought Situation Relieved by Rains

A SUBSTANTIAL rainfall during last Saturday and Sunday helped materially to relieve the drought situation in the Southeast. The unprecedented water shortage has necessitated in one instance curtailment of electric power supply. The smallest rainfall in years has resulted in the drying up of many of the smaller streams and reservoirs and materially reducing the height of water in many of the more important ones. All the hydro-electric companies throughout the Southeastern States have drawn heavily on their water reserves, and several companies have found it necessary to start up steam reserve plants.

Among the companies affected are the Carolina Power & Light Company and its subsidiaries. They found it necessary to suspend service to cotton mills from Thursday until the end of last week. Service was restored on Monday and had not been curtailed again when this was written. The large reservoir created by the Blewett Falls dam of the Yadkin River Power Company, a subsidiary, continues to give normal service, except for the temporary suspension to the cotton mills. The restrictions make it impossible to operate the Raleigh steam plant, which would otherwise give relief.

The Southern Power Company found itself well protected during the drought by the new Bridgewater storage reservoir. This was drawn down around 7 ft. or 8 ft. At the offices of the company in New York it was stated that there had been no curtailment whatever of service. It had, however, been necessary to start up the steam plants again at Greenville, Greensboro, Eno and Mount Holly, as many as three having been in operation at one time during the past two or three weeks. Recent rains, however, it was said, have relieved the situation.

A wire from the Georgia Railway & Power Company states that this company is not curtailing service nor are there any prospects of its having to do so. The company has in storage water representing 45,000,000 kw.-hr. and as yet has not considered it necessary to start steam plants.

Transmission Line Characteristics at 1,000,000 Volts Ascertained

TESTS were conducted at the high-voltage laboratory of the General Electric Company's Pittsfield works this week using voltages up to and above 1,000,000 to determine whether the corona and spark-over characteristics at these enormous voltages follow the laws which have been established for voltages below 250 kv. As a result of these tests, which were made at 60 cycles, engineers of the General Electric Company have concluded that it will be feasible to adopt considerably higher voltages for transmission than are now commercially employed. With the transmitting range permitted by 1,000,000 volts—namely, about 1,000 miles—it should be practicable to supply vast districts with power from the original source of energy such as waterfall, coal mine or oil well.

Among those principally responsible for these tests were C. C. Chesney, general manager of the Pittsfield works; F. W. Peek, Jr., G. Faccioli and W. S. Moody. In response to a request regarding the significance of these tests Mr. Peek replied as follows:

"For some time engineers have been able to predict with certainty the corona and spark-over characteristics of high-voltage transmission. These predictions were based on laws of corona established by careful tests made up to about 250 kv. and on spark-over curves established on needle and sphere gaps and line insulators at somewhat more than double this voltage. Commercial apparatus has already been built for 220-kv. operation.

"It was of great present theoretical and probably future practical interest to determine experimentally if there was a discontinuity in the established laws and curves at a million volts or over. Although no deviation was expected, we could not be certain until actual tests were made. We might, for instance, speculate that because of the great length of lightning sparks the air must be relatively weaker at the very high voltages.

"Tests up to about 1,100 kv. were made on the various elements entering a transmission line as follows: (a) The spark-over curve between points showed no discontinuity. The spark-over at 1,000 kv. was found to be about 105 in. (b) The spark-over curve between 75-cm. spheres showed no great deviation from calculated values. (c) Tests were made on strings of line insulators and the spark-over voltages were as expected; for instance, a string of eighteen standard suspension insulators arced over at about 900 kv., while a string of twenty-two insulators did not arc over at more than 1,000 kv. (d) Visual corona tests were made on 3½-in.-diameter brass-tube lines operating single-phase. The corona starting voltage (about 900 kv.) checked with the calculated value."

Great Need for Capital and Other Topics Discussed by Edison Companies

PROBLEMS facing the electric light and power industry were frankly discussed at the fortieth convention of the Association of Edison Illuminating Companies, held on Tuesday, Wednesday and Thursday of this week at Spring Lake, N. J. Mr. Edison himself was in attendance, and as an evidence of his inventive genius Dr. Clayton H. Sharp traced the significance of the "Edison effect" to the art of wireless communication and showed that long before Marconi had sent radio messages Edison had conceived the idea of signaling between ships and had actually taken out patents on a wireless system of communication. Unfortunately Edison was deterred from pursuing his investigations further, and it was left to others like Professor Fleming and Dr. De Forest to apply Edison's discovery to the art of wireless telegraphy and telephony.

In his presidential address Walter Johnson visualized the work before the industry. He saw wonderful opportunities ahead because the world looks to electricity for big things, and yet, alluring and real as is the vision, public support is necessary to bring it to fruition. Mr. Johnson said that it is no longer necessary to demonstrate the advantages of electricity. These are now accepted as fact and the experimental stage is past. In the present day money many times in excess of the invested capital is needed to finance new work, and he admonished his hearers to impress upon the public that investment in public utility securities, both senior and junior, is safe, wise and profitable.

The most interesting and valuable of all the committee reports read before the Edison association is that

of the lamp committee, presented now for many years by John W. Lieb. The report this year emphasized the fact that if the continued progress and expansion of the industry were to be assured, it was as necessary now as ever to give careful attention to standards of illumination and the provision of proper lamps. The past few years have amply demonstrated that the lighting load is a valuable stabilizer of station output and that it is the least affected by industrial depression and untoward business conditions. Mr. Lieb said it was gratifying to note, notwithstanding present business conditions, that there was no lull in research and investigations making for continued improvement in incandescent lamps.

On Wednesday evening Samuel Insull delivered a notable and intimate address on the development of the central station industry. Lucien H. Tyng, representing the Investment Bankers' Association of America, also addressed the association on that evening on some problems concerned with electric light and power company financing.

The committee on standards, of which W. C. L. Eglin is chairman, reported briefly on the status of the National Electrical Safety Code and the action of the American Engineering Standards Committee relating thereto. Improvements in meter supply were noted by P. H. Bartlett, chairman of the committee on metering and service methods, who also reported on late developments in demand and ampere-hour meters. A plea was made for liberal standardization of service and meter cabinets by both manufacturers and power companies, and gratification was expressed over the progress already made in standardizing service entrance cut-outs up to 100 amp. rating. L. L. Elden, reporting for the committee on electricity distribution and use, presented for consideration a series of subjects having an economic bearing on the electric light and power business. These subjects included interconnection, automatic substations, sectionalizing bus reactors, wireless installations, standard lamp voltages, wiring costs, temperature limits for insulation, cable specifications and terminals at substations.

Commercial Survey Made

All of Wednesday morning was given to a consideration of merchandising and commercial topics. Three papers were presented—one a survey of residential installations made by a sub-committee of the lamp committee headed by Clarence Law, the second a study of residence kilowatt-hours with reference to relative consumption by appliances and lamps, by C. J. Russell and T. W. Berger, and the third a paper on the economics of electrical merchandising, by George P. Baldwin. The survey made by Messrs. Russell and Berger in Philadelphia, although it covered only one month's use of lamps and appliances, is undoubtedly one of the most important studies of residential circuits made in recent years. It indicated that by means of greater appliance loads residential business may be made more attractive to the electric light and power companies of the country and by that means the saturation of the dollar invested may be more nearly accomplished.

Papers dealing with the engineering features of central-station work were presented on Thursday. These included reports of committees on steam turbines and generators, power factor and fuel. Prof. J. P Jackson delivered a very timely address on the interrelation of power systems.

Plan Merger of Doherty Properties in Toledo

STEPS are being taken to effect the consolidation of the Toledo (Ohio) Railways & Light Company and the Acme Power Company, both controlled by Henry L. Doherty & Company. A special stockholders' meeting of the Toledo Railways & Light Company is called for Oct. 10 to vote on a change of name, an increase of capital from $15,000,000 to $25,000,000 and the proposed merger with the Acme Power Company. Since the Toledo Railways & Light Company's street-railway properties in Toledo were transferred early this year to the Community Traction Company, a municipal project, the company has proposed to change its name to the Toledo Edison Company and effect the merger with the Acme Power Company. Details of the financial plan of the new company have not yet been announced, but it is understood that a complete financial reorganization will be made.

Little Damage to San Antonio Utilities In Flood of Sept. 10

DAMAGE to the property of the San Antonio (Tex.) Public Service Company as a result of the flood on Saturday, Sept. 10, was slight. At the New York office of the American Light & Traction Company, which controls the electric light and power, street railway and gas utilities in San Antonio, it was stated that there was little or no physical damage to any of the company's property. Only one of the company's plants, a comparatively small one, known as Station B, was reached by flood water, and while detailed reports had not yet been received as to the extent of the damage, it was not believed that the total cost of clearing away débris and making necessary repairs would exceed $20,000.

Electric service was interrupted shortly after the flood started about 1 o'clock Saturday morning, but was restored at 8 o'clock in the evening of the same day. Traction service was resumed on Sunday morning. The gas service was affected the least.

Massachusetts Utilities Again Seek Premium Capitalization

TO BROADEN the market for gas and electric securities in Massachusetts, the capitalization of premiums was urged before the Department of Public Utilities at Boston Sept. 13, at a hearing given by the commission in response to a resolve of the last Legislature. E. W. Burdett, for the fifty-three utilities composing the Massachusetts Gas and Electric Association and including leading companies in the state, addressed the board. Four recommendations for legislation were presented by Mr. Burdett to the commission, which is investigating the general problem of utility capitalization with instructions to report its findings and suggestions to the incoming Legislature next January. The recommendations were these: (1) That the department may approve the issue of stock below par in cases of necessity; (2) that the commission establish the issue prices of bonds and their rate of interest; (3) that the cash and share capital of companies be equalized under supervision of the commission; (4) that the commission may authorize the issue of capital stock without par value.

Colorado River Dam Is Federal Project, Secretary Fall Says

SECRETARY FALL of the Department of the Interior is in favor of the construction of the Boulder Canyon dam on the Colorado River by the federal government, according to advices just received in California from A. P. Davis, chief of the United States Reclamation Service. This significant declaration is the first authentic disclosure of the attitude of the Secretary, who must pass on the project both as Secretary of the Interior and as a member of the Federal Power Commission. According to Mr. Davis, the Secretary believes that no dam should be built on the Colorado River by any authority except the United States, the enterprise being altogether too large, too important and involving too many interstate and international problems to permit of its being undertaken by any other than the federal government. The communication from Mr. Davis further says: "The Secretary thinks it is not desirable to permit any of the interests to contribute to the investigations, but in view of the urgency of the matter has consented that all municipalities may be invited to do so for the present in order to keep the work going and forestall delay." The Secretary has instructed Mr. Davis to prepare estimates in the amount of $100,000 to further investigate the Boulder Canyon project. Contributions to this fund are to be solicited from the interested municipalities with the explicit agreement that such contributions do not involve any moral or legal advantage concerning the allocation of benefits from the completed project.

Arrangements Made for 168,000-Hp. Plant to Feed Into Winnipeg

ARRANGEMENTS have been completed for the financing of a ten-million-dollar power development project at Great Falls on the Winnipeg River in Manitoba, Canada. A. W. McLimont, vice-president of the Winnipeg Electric Railway, has recently returned from a trip to Montreal, where he was in consultation with the firm of Nesbitt, Thomson & Company, who will finance the undertaking. When completed the plant will have a capacity of 168,000 hp. Work has begun and about 200 men are now employed. This force will later be increased to between 1,500 and 2,500 men, and the whole plant, it is expected, will be finished in 1927.

The undertaking will be carried out under the charter of the Manitoba Power Company, Ltd., which company is taking over the assets of the Winnipeg River Power Company. Sir Augustus Nantan of Winnipeg, who is also a director of the Winnipeg Electric Railway, will be president and A. W. McLimont will be vice-president of the Manitoba Power Company.

Public Relations the Keynote of Pennsylvania Electric Association Convention

THE fourteenth annual convention of the Pennsylvania Electric Association was held at Bedford Springs, Pa., on Thursday, Friday and Saturday of last week. Chief interest in the program was centered in a public policy meeting on the evening of Sept. 8, at which President M. R. Bump of the National Electric Light Association; A. W. Thompson, president of the Duquesne Light Company of Pittsburgh, and W. D. B. Ainey, chairman of the Public Service Commission of the Commonwealth of Pennsylvania, spoke.

LARGE AND ENTHUSIASTIC ATTENDANCE AT BEDFORD SPRINGS CONVENTION

Papers were presented during the convention as follows: "Superpower Survey as It May Affect Pennsylvania," by Harold Goodwin, Jr.; "The Uses and Value of Classified Cost-of-Service Data as Supplementary Evidence in Certain Types of Rate Cases," by Charles E. Cooke, Jr.; "Closer Co-operation with Our Customers," by W. H. Wade; "Electric Service for Rural Customers," by C. W. Drake; "Inductive Interference," by A. E. Silver; "Light and Power Company Hazards as Viewed by the Department," by Clifford Connelly, and "Accident Prevention Among Electric Utilities," by Paul R. Kuhn. In addition there were reports from the following committees: Rates, F. S. Smith chairman; Commercial Section relations, G. M. Gadsby chairman; Technical Section, Henry Müller chairman; safety and welfare, J. H. Shearer chairman; Accounting Section, H. R. Kern chairman; purchasing and storeroom accounting, J. F. Torrence chairman; customers' records and billing methods, John F. Ford chairman; credits and collections, C. F. Kalp chairman.

In his presidential address Henry Harris of Wilmerding reviewed briefly the accomplishments of the year and laid stress on what was yet to be done, especially in the way of service, financing and winning public good will. Much that he said was re-echoed in fuller detail at the public policy meeting. Mr. Bump was certain that the securities of electric public utilities will remain attractive for many years to come. He outlined the plans of the N. E. L. A., calling attention to the Customer Ownership Service Bureau recently established at headquarters in New York, to the general good-will program, and to the relationship established with the telephone companies for amicably settling inductive-interference troubles.

Service was the keynote of A. W. Thompson's address. While probably not more than 5 per cent of the customers indulge in adverse criticism of the service, yet Mr. Thompson said, success or failure is measured by the manner in which these complaints are handled. Mr. Thompson also called attention to the service necessary to the employee to make him contented and happy and the service to the investor whereby additional capital may be attracted to securities of the local companies.

Commissioner Ainey expressed his confidence in the ability of the electrical industry to solve the problems before it. He declared it to be one of the most essential parts of the fabric of human civilization and progress and said that such associations as the Pennsylvania Electric Association and the National Electric Light Association are of untold assistance to the regulatory authorities because through them the commissions receive the composite thought and practices of the utilities and are able to adjudicate matters for the good of the individual, the community and the nation.

Mr. Goodwin in his paper dealt with some of the commercial and engineering aspects of the Superpower Survey recently made in the Northeastern section of the United States, the final report on which is soon to be distributed. The executive, legal and financial phases were not touched on. Standard distribution voltages for the Superpower Zone were recommended as follows: 2,300 volts, 23,000 volts and 66,000 volts. Particular emphasis was laid on the virtues of 66,000 volts as against higher voltages, and use of this voltage with pin-type insulators was advocated.

At the closing session of Saturday A. S. Cantlin of Allentown was elected president, H. H. Ganser of Norristown was elected first vice-president and E. H. Davis of Williamsport second vice-president. J. H. Shearer of Altoona was elected treasurer.

First Application from New England for Preliminary Hydro Permit

THE meeting of the Federal Power Commission which was scheduled for Sept. 12 was postponed owing to the fact that the Secretary of War was called out of the city. The meeting will be held immediately on his return. At that meeting the commission will pass upon the request of the Connecticut River Power Company for a preliminary permit covering the project at Enfield Rapids on the Connecticut River, where it is intended to develop 32,000 installed horsepower. This will be the first preliminary permit to be granted in New England since the enactment of the water-power act. It is expected that the commission will reject the application of A. P. Connor of Springfield, Mass., which covers the same site. The commission at its next meeting will also pass upon an application by George C. Hazlett of Cordoba, Alaska, for a preliminary permit covering a project at the outlet of Silver Lake in Alaska in which 5,000 hp. is involved.

Application has been made to the commission by the Uinta Power & Light Company for a preliminary permit covering a Utah project, in which some 6,000 hp. is involved, and by the Darwin Silver Company of California for a license covering a transmission line from one of the power plants serving the city of Los Angeles to a near-by mine.

Salesmanship and Customer Ownership to Be Discussed at French Lick Springs

THE program of the Great Lakes Geographic Division, N. E. L. A., and Indiana Electric Light Association convention at the French Lick Springs Hotel, French Lick Springs, Ind., Sept. 21-24, will include addresses by President Bump and Executive Manager Aylesworth of the National Electric Light Association. Dr. Holmes, president of Drake University, Des Moines, Iowa, will discuss salesmanship. The electric vehicle situation will also be discussed, and the technical sessions on Friday morning will be addressed by Chairman Carle of the National Technical Section. The program in full is as follows:

WEDNESDAY, SEPT. 21

9:30 A.M.—President's address, William C. Lounsbury, Superior, Wis.; reports of committees; report of secretary-treasurer; address, "Facts and Feeling in Salesmanship," by Dr. A. Holmes, president Drake University, Des Moines, Iowa; address, "Contract Routine," by R. T. Duncan, Detroit Edison Company; report, "Investigation Upon the Relation of Kilowatt-Hours Sold for Appliances and for Lighting in the Average Household," by T. W. Berger, Philadelphia, Pa., and George A. Neal, Hammond, Ind.; address, "Illinois Committee on Public Information and Its Future Plans," by B. J. Mullaney, Chicago; report, "The Electric Vehicle," by Messrs. Cunningham and Carpenter, Chicago.

THURSDAY, SEPT. 22

9:30 A.M.—Address, "Consumer Ownership of Utilities," by R. F. Scheel, Chicago; address, "Public Service," by George P. Barnard, Indiana Public Service Commission; address, "Central-Station Publicity," by J. B. Wootan, New York City; address, "Training for Public Service," by Fred R. Jenkins, chairman educational committee N. E. L. A.; address, M. H. Aylesworth, executive manager N. E. L. A.

FRIDAY, SEPT. 23

9:30 A.M.—Report of technical committee, by George E. Lewis, Ann Arbor, Mich.; paper, "Michigan High-Voltage Transmission Systems," by H. J. Burton, Jackson, Mich.; report of meter committee, by J. C. Langdell, Jackson, Mich.; address, by N. A. Carle, chairman technical committee N. E. L. A.; paper, "Distribution Systems in Small Communities" (author to be named); general discussion on consumers' billing methods led by B. P. Shearon, Hammond, Ind.; J. H. Thomas, Peoria, Ill.; C. H. Hansberger, Grand Rapids, Mich.; H. C. Mitchell, Indianapolis, Ind., and W. A. McDonough, Beloit, Wis.; demonstration of latest mechanical drilling devices.

7:30 P.M.—Address, by Milan R. Bump, president N. E. L. A.; distribution of golf prizes.

THIRTEENTH ANNUAL MEETING INDIANA ELECTRIC LIGHT ASSOCIATION, SATURDAY, SEPT. 24

9:30 A.M.—Reports of committees; report of secretary-treasurer; president's address, by Morse DellPlain, Hammond, Ind.; address, "Capitalizing Your Opportunities," by William L. Goodwin, Society for Electrical Development; address, M. H. Aylesworth, executive manager N. E. L. A.; round-table discussion; election of officers.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Central Maine Power Company Has 7,000 Stockholders.—In the fiscal year ended on June 20 last the Central Maine Power Company gained 3,042 stockholders, which it considers a record for a company with 36,000 customers. These new purchasers brought the number of holders of 7 per cent stock up to 5,968, and, adding in the holders of 6 per cent and common stock, the company now has more than 7,000 investors in its securities.

Prizes for Advertisements and "Stories" of Utility Companies. — J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, has announced that last year's prize contest among the students of the school of journalism of the University of Oklahoma for the best advertisements and "feature stories" regarding public utilities companies will be made a permanent institution. Five prizes of $5 each for the best monthly contributions and a grand prize of $50 will be awarded each year.

Church Services by Radio.—In Pittsburgh recently the congregation of the Herron Avenue Presbyterian Church, whose pastor was absent, listened to the services. including music and sermon, given at another church 10 miles distant and transmitted by radio telephony and through an amplifier. This innovation was an extension of an arrangement by which the entire religious service of the Calvary Episcopal Church at Pittsburgh is transmitted by radio every Sunday evening to amateur radio stations equipped with the proper receiving and amplifying apparatus. The sermon from the loud-speaking horn is said to have been distinctly heard in all parts of the auditorium.

Turbo-Generator Runs Five Years Without a Breakdown.—For five years a 3,200-kva. Westinghouse turbo-generator has been operated in the city of Saskatoon, Saskatchewan, Canada, without a breakdown and with only a few short stops on account of a light load that could be carried by a smaller turbine. One continuous run of eighteen months is recorded. This record is the more remarkable because of the extremes of mperature encountered in the Canadian Northwest. The loads carried by this machine have varied from 300 kw. to 3,850 kw. The only portion of the equipment that was ever removed was the governor pedestal cap, which was taken off for the purpose of renewing a gasket on the gland runner joint. The condenser, too, has proved reliable. On one occasion when ice shut off the water intake seventeen times in an eight-hour run no trouble to the tubes or plates occurred. The La Blanc air pump never has given any trouble with condensing water at a proper temperature. The turbo-generator is still "going strong."

Wireless Contest to Be Held at New York Electrical Show.—A world's championship speed contest in wireless telegraphy is to be held in New York on Sept. 28, 29 and 30 in connection with the New York Electrical Show at the Seventy-first Regiment Armory. The contest will be open to all comers and some of the fastest army, navy and commercial operators are expected to take part. A silver cup will be presented to the winner. The contest will be under the auspices of the National Amateur Wireless Association and will be conducted by a committee representing the government departments and the commercial telegraph companies. In addition to the professional contest there will be a test in receiving messages through interference. This will be limited strictly to amateurs.

Diesel-Electric Yacht Passes Her Trials.—The Guinevere, a three-masted schooner designed by A. Loring Swasey and built at Neponset, Mass., with a water-line length of 165 ft., over-all length of 195 ft., beam of 33 ft. and displacement of 642 tons, depends for her auxiliary power on Diesel-electric engines. Her power plant consists of two six-cylinder, 350-hp. Winton oil engines operating at 225 r.p.m., each of which is directly connected to a 225-kw., 125-volt Westinghouse direct-current generator. Power from these generators is supplied to the Westinghouse propeller motor, which is a 550-hp., 250-volt, 220-r.p.m. machine. On her trials the Guinevere ran over a measured course of 5¼ nautical miles between Boston Light and the lightship and showed a speed of 11.62 knots, which is a knot more than contract speed.

Commission Tries to End Electrical Strife at Goshen, Ind.—In an effort to terminate the competition that has existed in Goshen, Ind., for twenty-five years between the municipal electric light service and the Hawks Electric Company, the Indiana Public Service Commission has recommended that the rival purveyors of energy either consolidate or divide the territory between them. This advice is contained in an order authorizing the company, from which the city purchases energy, to increase its wholesale rate from 1.45 cents to 2 cents a kilowatt-hour despite a ten-year contract at the former rate entered into less than two years ago. Rates to householders and commercial light users were also raised by from 10 to 15 per cent, and a smaller increase to power consumers was authorized, these advances being in addition to previous ones granted last December. A few years ago the city shut down its own generating plant and contracted with the company for energy, and much bitter feeling has been caused by the resulting situation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Philadelphia Section, I. and S. E. E.—The first fall meeting of the Philadelphia Section of the Iron and Steel Electrical Engineers will be held at the Engineers' Club building on Saturday, Oct. 1, at 8:15 p. m., when the topic for discussion will be "Power Distribution in Industrial Plants."

National Association of Railway and Utilities Commissioners.—This association will hold its annual meeting at Atlanta, Ga., on Tuesday to Friday, Oct. 11 to 14, under the presidency of James A. Perry of the Georgia Railroad Commission. President Bump and Executive Manager Aylesworth of the N. E. L. A. will be present.

N. E. L. A., Rocky Mountain Division.—As already announced, the second annual convention of this association will be held, in conjunction with the annual convention of the Colorado Electric Light, Power and Railway Association, at the Hotel Colorado, Glenwood Springs, Col., on Sept. 19, 20 and 21. Men nationally prominent in electrical activities will, it is announced, address the gathering. The executive committee of the Accounting Section, N. E. L. A., will meet in Glenwood Springs on Sept. 20, concurrently with the Rocky Mountain division.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24. (For program see issue of Sept. 10, page 535.)

N. E. L. A., Great Lakes Division, and Indiana Electric Light Association — French Lick Springs, Sept. 21-23. (For program see "News of the Industry.")

N. E. L. A., Rocky Mountain Division, and Colorado Electric Light, Power and Railway Association — Glenwood Springs, Sept. 19-21.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Electrical Supply Jobbers' Association, Central Division—Chicago, Sept. 22 to 23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-29. (For program see issue of Aug. 13, page 336.)

National Safety Council—Boston, Sept. 26-30.

American Electrochemical Society — Lake Placid Club, N. Y., Sept. 29-Oct. 1.

A. I. and S. E. E., Philadelphia Section—Philadelphia, Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Indiana State Association of Electrical Contractors and Dealers — Indianapolis, Oct. 5 and 6.

Empire State Gas and Electric Association —Lake Placid, N. Y., Oct. 6 and 7.

National Association of Railway and Utilities Commissioners—Atlanta, Ga., Oct. 11-14.

N. E. L. A., Southeastern Section—Chattanooga, Tenn., Oct. 17-19.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 20.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Responsibility for Unhealthful Conditions Attributed to Power Company's Dam.—The Georgia Court of Appeals has reversed a verdict for the defendant directed by the lower court in Head vs. Towaliga Power Company and ordered a retrial. This is a suit for damages on account of a nuisance and menace to health alleged to have been caused by the backing up of waters obstructed by a dam erected by the power company across the Towaliga River. The higher court held that there was evidence supporting a verdict for damages in some amount and no evidence supporting a verdict for the defendant.

What Constitutes an Extraordinary Flood?—In affirming a judgment for flood damages in Cheatwood vs. City of Richmond, the Supreme Court of Appeals of Virginia thus summarized the law as it bears upon "extraordinary" floods for which damages are not recoverable: "The law is perfectly well settled that no person or corporation has a right to construct a culvert over a natural watercourse in such manner as to obstruct the flow of the stream and throw its waters back on another owner's property to its injury, and the culvert or opening must be sufficient to accommodate not only the natural and normal flow of the stream but such abnormal and excessive flow as may reasonably be anticipated in times of high water and flood. There is no duty to provide for floods so unusual and extraordinary as to bring them within the category of an 'act of God.'" (107 S. E. 830.)*

Commission Cannot Reduce Rental of Property Leased by Public Utility.—Where the owner of property devoted to public service has leased it in whole or in part to an operating company for a specified compensation, the Public Service Commission, according to a decision of the Supreme Court of Pennsylvania in a suit brought by the New Street Bridge Company against the commission, can only determine the reasonableness of the rates charged to the public for the service and cannot reduce the compensation paid by the lessee for the use of the property, in which the public has no interest. The commission has no power to subject a lessor or owning company to the duties or obligations of an operating company. The power of the commission extends only to regulation of rates to insure reasonable charges and prevent discrimination and does not permit regulation to reduce contract charges solely for the benefit of the contracting consumers. (114 At. 378.)

What Is Confiscation?—The fixation of rates for a public service corporation cannot be a confiscation, declared the Supreme Court of Pennsylvania in handing down a decision on a disputed commission order (Ben Avon Borough vs. Ohio Valley Water Company), when the utility company receives a reasonable return on its investment, but if it is deprived thereof confiscation necessarily results. The discretion exercised in settling this point by the lower court will not lead to reversal by the Supreme Court unless it is satisfied that this discretion has been abused. The same fundamental principle was affirmed by the Supreme Court in Beaver Valley Water Company vs. Public Service Commission. (114 At. 369.)

Liability of Owner of Building and of Corporation Supplying Electricity for Death from Defective Wiring.—A dairy employee having met death because of grounded wires in the premises of a customer where he tried to reach a switch to turn on the light, the Appellate Court of Indiana (Aurentz vs. Nierman) found that the owner of the building, who knew that the wiring was defective, could not protect himself against liability by the claim that he was not an electrical expert and had relied on the opinion of others, it being his duty to have the defect removed. Nor could the city of Fort Wayne, which furnished the electricity and which had acquired knowledge by inspection on the complaint of the building owner of the defective conditions, escape responsibility because it did not control the building and had not been authorized to make the necessary repairs. (131 N. E. 832.)

Grand Rapids Ordinance Not a Franchise.—The Superior Court of Grand Rapids, Mich., has sustained the Consumers' Power Company in a suit brought against it by the city to enforce rates advertised by the company in 1907 and afterward put into force. These rates were less than those granted in an ordinance passed by the City Council previous to the company's advertisement and subsequently to this advertisement adopted by public referendum. The company has now reverted to the rates originally named in the ordinance. The city's contention was that the ordinance was a franchise and that the company by its own action had substituted the lower rates for those included in the ordinance, these lower rates thus becoming the legal ones. The city had, however, granted an emergency increase to the company on Nov. 4, 1920. It claimed that the rates the company is now charging under the original terms of the ordinance are higher than those accorded in this emergency measure and should be disallowed.

* The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Commission Cannot Act in Capacity of Consulting Engineer for Projected Plants.—The Michigan Public Utilities Commission declined to act, at the request of a village contemplating the installation of a municipal electric plant, as a consulting engineer in the preparation of plans, surveys and reports, holding that the advisory functions bestowed on the commission by statute refer only to plants already built and in operation.

Going Value Predicated on Efficiency.—A public utility which is not above the ordinary in the way of operating costs and operating efficiency is not entitled to a going value representing the difference between a utility having a working organization and a business attached to its system and one which has not, according to a decision of the Michigan Public Utilities Commission, although a utility which is superior on account of foresight in design and operation is entitled to a larger allowance for going value than one which falls short in these respects.

Relation of Efficient Operation to Return.—The Light & Power Utility, which operates an electric distribution system in Banning, Cal., requested authority to increase its rates, urging that it was not earning a fair return on the capital invested. The California Railroad Commission declined to allow the increase, saying: "There is and has been a general complaint by applicant's consumers regarding the attitude and manner of applicant in carrying on its business, which prevents its proper and natural development. The commission has urged applicant from time to time to improve these conditions for the betterment of service to consumers and increase of business to applicant. It is the firm conviction of the commission's engineers that applicant's business could be increased to a point where it would pay an adequate return under present rates. Under these conditions the commission does not feel justified in authorizing an increase in rates at this time, and the return is fair, considering the service given. . . . If in the future applicant shows to the commission satisfactorily that it has made suitable changes to improve its conditions and has made a sincere and intelligent effort to develop the business properly, but that an increase in rates is still needed to provide an adequate return, the matter may again be brought to the commission's attention by the filing of a new application."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

S. Fred Smith, local manager for Charles H. Tenney & Company of the Salem (Mass.) Electric Lighting Company, celebrated on Aug. 16 the thirtieth anniversary of his appointment as

S. F. SMITH

manager. Mr. Smith became connected with the electrical industry in its pioneer days, having been made manager of the Salem telephone exchange in 1881. When he resigned that post in 1891 to become manager of the lighting company, he was succeeded by Robert P. Butterick, who has remained manager of the telephone property ever since, and the two electrical veterans observed together the completion of their third managerial decade. Mr. Smith has seen the Salem Electric Lighting Company expand from the status of an 800-hp. plant to its present size, with an output of 43,000,000 kw.-hr. a year. The system, which is interconnected with Boston, Revere and Walden, ranks as one of the most efficient in New England, generating a kilowatt-hour on about 1.8 lb. of coal.

E. A. Loew, associate professor of electrical engineering at the University of Washington in Seattle, has become connected with the ELECTRICAL WORLD as editorial representative in his territory. His new activities will be in addition to his college duties. Mr. Loew was graduated in electrical engineering from the University of Wisconsin in 1906. Both before and after graduation he gained considerable practical experience with the Chicago Telephone Company, the Wisconsin Telephone Company and the United States government. He then served three years as instructor in electrical engineering at the University of Wisconsin, and then as first assistant professor and later as associate professor of electrical engineering at the University of Washington for nine years. During a leave of absence of three years he was electrical engineer and general superintendent of the American Nitrogen Products Company of Seattle. Mr. Loew is a member of the American Institute of Electrical Engineers and has been active on both local and national committees of the Institute.

Edwin A. Barrows, president of the Narragansett Electric Lighting Company of Providence, R. I., has been elected vice-president of the New England Section of the N. E. L. A.

J. M. Wauchope has been appointed superintendent of the Walla Walla River plant of the Pacific Power & Light Company, Milton, Ore.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, has been elected president of the New England Section of the N. E. L. A. Mr. Edgar has been prominently identified with N. E. L. A. work, both in the national and local organizations, for a number of years. He has served several times as vice-president of the N. E. L. A. and was president in 1903. He has been closely identified with the electrical industry for thirty-seven years, thirty-three of which have been devoted to the engi-

C. L. EDGAR

neering, commercial and executive departments of the Edison Electric Illuminating Company of Boston. Owing to his broad outlook and experience he is widely looked to for counsel and leadership in all phases of central-station work.

L. L. Dyer, until recently assistant superintendent of transmission of the Southern California Edison Company, has been promoted to be superintendent of substation operation and will have charge of the operations of all of the company's many substations. Mr. Dyer has been employed by the Southern California Edison Company and its predecessors for nearly twenty years, having entered the employ of the Pacific Light & Power Company as dynamo tender in 1902. Before this he was an electrician in the navy, serving in the battle of Manila Bay. In 1907 he became substation chief and

L. L. DYER

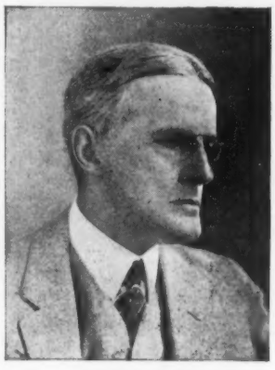
in 1909 chief of the electrical department of the Redondo steam generating station. He became system chief operator in 1910 and was promoted to the position of superintendent of the southern division in 1913. Upon the merger of the Pacific Light & Power Company with the Southern California Edison Company in 1917 he was made assistant superintendent of transmission of the latter company and held this position until his recent promotion.

J. A. Woidill, Jr., formerly chief electrical draftsman at the Hog Island shipyard, has recently become superintendent of the Atlantic County Electric Company and Enterprise Gas Company, Egg Harbor City, N. J.

W. S. Richmond, consulting engineer in hydro-electric and general hydraulic problems, has moved from Detroit to Buffalo, where he will continue practice.

R. H. Bacon, who since early in 1920 has been an associate engineering editor of the ELECTRICAL WORLD, has recently been appointed head of the sales promotion and advertising section of the Imperial Electric Company, Akron, Ohio. Mr. Bacon previous to his connection with the ELECTRICAL WORLD was assistant electrical engineer of the Copper Range Company, Painesdale, Mich. Prior to that connection he had been employed by the Eastern Michigan Power Company, by Woodmansee & Davidson, Chicago, by the L. K. Comstock Company of New York City and by other operating concerns.

W. A. Stearns, who has recently been appointed chairman of the Heating Appliance Section of the Associated Manufacturers of Electrical Supplies, is supervisor of the nickel-chromium resistance-element patents of the General Electric Company. Mr. Stearns has been in the employ of the Fort Wayne Electric Company and the General Electric Company since April, 1904. At that time he joined the sales force of the former company. In September, 1905, he was made sales manager of the Southern district of the Fort Wayne Electric Works, with headquarters at Atlanta, Ga. Four years later he was appointed district manager of the supply department of the General Electric Company at Atlanta. In 1911 he was made assistant sales manager of the Atlanta office of the General Electric Company. In April, 1916, he was transferred to Pittsfield, Mass., as manager of the heating appliance section of the supply department, but later he moved to Schenectady to become supervisor of the patents already mentioned. Two years afterward he was placed in charge of the licenses granted by the General Electric Company under the patents owned by it. Mr. Stearns has served on various merchandising committees of the N. E. L. A. having to do with commercial and testing subjects.



W. A. STEARNS

W. W. Mumma, formerly sales manager of the fan department of the Robbins & Myers Company, has been appointed general sales manager, with jurisdiction over fan and motor sales.

Martin J. Wolf, second vice-president and director of W. N. Matthews & Brother, Inc., St. Louis, has been granted an indefinite leave of absence upon request. Mr. Wolf has been associated with the company for more than seven years. He will retain his directorship and official position with it.

George Y. Watt has been appointed New England district manager of the Century Electric Company of St. Louis, Mo., with offices at 10 High Street, Boston. Mr. Watt is a graduate of the electrical engineering course of the Brooklyn (N. Y.) Polytechnic Institute and has been in the Century company's organization about eleven years. During the war he served in the United States Navy for eighteen months. At the time of his appointment to the New England post he was manager of the export department of the Century company.

R. R. Reid has been appointed sales engineer with the Utah Electric & Motor Equipment Company at Salt Lake City. His duties in this newly created position will keep him on the firing line to promote the development of business in electrical contracting, furnishing estimates, etc., particularly in connection with the construction of new buildings. Mr. Reid has had many years' experience in this line of work, having had charge of the electrical work on some of Salt Lake's big buildings and important construction work in the Intermountain West.

Henry W. Marshall, who for a number of years was president of the Public Utilities Company of Evansville, Ind., and who served as vice-president before that time, has been elected vice-president of Purdue University, Lafayette, Ind., with the full powers and duties of president. He will direct the affairs of the university until such time as a successor to the late Dr. Winthrop E. Stone is selected. Mr. Marshall's earlier business experience was gained in the construction industry, and he was president of the Lafayette Bridge Company until its absorption by the American Bridge Company. He is the owner of a daily newspaper, the Lafayette *Journal and Courier,* and for four terms was a representative in the Indiana General Assembly, during one of which he served as Speaker.

H. W. MARSHALL

A. J. Reed of the sales department of the Robbins & Myers Company, who for several years has been manager of the Cleveland branch, has been appointed assistant sales manager of the motor department.

Obituary

Samuel Alfred Varley, a pioneer English electrical engineer, to whom has been ascribed the credit for the compound-wound dynamo, died recently at Winchester, England, at the age of ninety. Mr. Varley was in all probability the last surviving pupil of Michael Faraday. In 1866 he constructed "the first machine which might correctly be termed a dynamo." This is now on exhibition in the South Kensington Museum in London.

George C. Killeen, superintendent of the Southern New York Power & Railway Corporation, which controls the Southern New York Power Company of Cooperstown, N. Y., died on Aug. 31, at the age of forty-six. He was in charge both of the power plants and the trolley lines of the company. Mr. Killeen was born at Elizabeth, N. J., and had for many years held responsible positions in the shops and power houses of electric railway companies in the East.

Frederick Upham Adams, a well known popular and scientific writer, died on Aug. 28 at Larchmont, N. Y. He was born in Boston on Dec. 10, 1859, was graduated from the Elgin (Ill.) High School in 1876 and then studied mechanical engineering. Mr. Adams invented a type of post for electric lamps and also a type of electric light tower.

Earl S. James, assistant superintendent of the electric department of the Oklahoma Gas & Electric Company, died Aug. 28 as a result of injuries sustained when he came in contact with a high-voltage wire on the outdoor substation of the plant at Oklahoma City. Mr. James had served the company efficiently for fourteen years in nearly every position included in his department.

Percy Chandler Henry, superintendent of distribution, New England Power Company, Worcester, Mass., and W. B. Bush, president Bush Electric Company, Cleveland, Ohio, were accidentally killed at the Greendale substation of the New England Company near Worcester on Sept. 9, while testing insulators on the 66,000-volt lines of the system. Mr. Bush had gone to Worcester after conducting a successful demonstration at the New London convention of the New England Division, N. E. L. A. He was about thirty-five years of age. Mr. Henry became superintendent of distribution for the New England Power Company in the fall of 1920. He was a graduate of Purdue University and, besides having been employed by the Commonwealth Edison Company, Chicago, and the Indiana Steel Company, had been electrical superintendent of the Massena (N. Y.) plant of the American Aluminum Company. Mr. Henry was about thirty-two years old.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Building Operations in August Show Increased Activity

CONSTRUCTION activity in August, according to figures published by the F. W. Dodge Company, was 4 per cent greater than in July and 9 per cent greater than in August, 1920. Contracts awarded during August, 1921, in the twenty-seven Northeastern states of the country amounted to $220,922,000. New England's proportion of this was 9.3 per cent; New York State and Northern New Jersey accounted for 27.6 per cent; 17.2 per cent went to the Middle Atlantic States and 14.9 to the Pittsburgh district; the Central West accounted for 27.3 per cent, and the Northwest for 3.6 per cent.

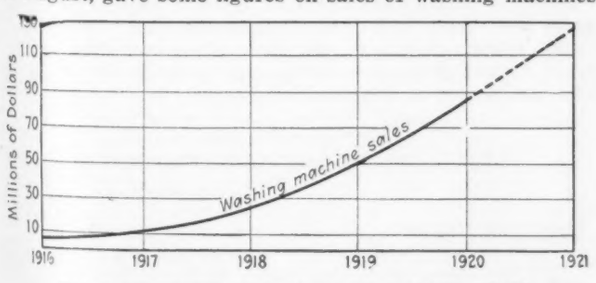
Residential construction continues in the lead over all other classes of buildings, says the report. It accounted for 36 per cent of the total in August, amounting to $80,329,000. Public works and utilities amounted to $44,797,000, or 20 per cent of the total; business building, to $35,526,000, or 16 per cent; educational buildings to $27,959,000, or 13 per cent, and industrial buildings to $10,832,000, or 5 per cent.

Contracts awarded for mercantile buildings in August amounted to more than for any previous month of this year. The total volume of contracts let in the territory covered by the F. W. Dodge Company during the first eight months of this year has been 10 per cent greater than the average for the first eight months of the preceding five years.

Contemplated new work reported from Jan. 1 to Sept. 1, 1921, has amounted to $3,202,731,000, which is more than double the amount of contracts awarded in the same period.

Sales of Washing Machines During Last Five Years

IN DISCUSSING the market for electric washing machines, Enoch B. Seitz, secretary of the American Washing Machine Manufacturers' Association, speaking before a gathering of electrical contractor-dealers in Chicago early in August, gave some figures on sales of washing machines



SALES INCREASED RAPIDLY IN LAST THREE YEARS

in the last five years. Sales in 1916 amounted to $7,000,000; in 1917 they were $11,000,000; in 1918 they came to $24,000,000; sales in 1919 doubled to $50,000,000 and in 1920 they amounted to $85,000,000. These figures have been plotted to form the curve reproduced herewith. If this curve were extended to cover the year 1921, it would show sales in the present year to an amount of approximately $125,000,000. But from the rate of washing-machine production and sales to date during 1921 it would seem that this figure will not be attained this year.

The speaker used the figure of 2,500,000 as the number of washing machines in use at the present time and stated that the value of sales in 1919 represented 1,000,000 machines and sales in 1920 represented 880,000 machines. Figures for the previous years were not given.

In the year 1919 it is estimated that there were approximately 7,000,000 homes in the United States which were wired for electricity and about 14,000,000 unwired. The former figure now would probably be nearer 8,000,000, giving a total of 22,000,000 homes. It is easy to see the market for washing machines not only in those homes which are already wired but also in those that remain still to be wired.

Review of Air-Heater Market for Coming Season

OPINIONS among jobbers differ as to the prospects offered for a good season in sales of electric air heaters during the coming winter of 1921-1922. Advices received from this trade in the principal centers of the country seem to take almost an evenly divided stand on this matter, with the preponderance of opinion leaning toward a good season. The New England jobbers are looking for a very good volume of sales, even closely approaching that of last season. The continued high cost of coal and active sales effort are expected to yield due results in this direction, effecting economies by this method of heating limited spaces and of removing chill from larger spaces. At the same time sharp competition is expected there from new lower-priced designs, some of which, it is said, may retail at 50 to 60 per cent of the price of present types.

From several sections it is reported that present prices are expected to act as a sure deterrent to sales in the coming season. In general these prices are about one dollar lower than they were last season, the range varying between $11 and $12.50, depending on the type. Last spring retailers lowered their prices to around $9 and $10 and moved a good amount of their stock.

Nineteen New England jobbers will probably buy from 6,000 to 6,500 heaters from now to Jan. 1, and the chances are that half of these will be ordered by Oct. 15. By Sept. 1 about 6,000 heaters had been ordered. The holdover there from last season amounted to about 2,700 heaters—varying in amounts from a dozen to 500. These nineteen jobbers sold approximately 20,000 heaters last season, and it is estimated that the total New England sales amounted to between 27,000 and 30,000.

Buying Expected Early in October

The New York market is ordering only in small amounts to date as only a moderate season is anticipated at this time. From the first to the fifteenth of October seems to be the time during which orders will be placed. Still, the holdover from last season is not considered high. Several jobbers report no stocks, and there are probably not more than 4,000 heaters in jobbers' stocks in the whole metropolitan district. The attitude is to go slow and feel out the weather. Convenient distributers' stocks are an assistance in this method of buying. Sales in that territory last season probably amounted to between 27,000 and 30,000 heaters.

Extreme caution in the buying of heater stocks for the coming fall and winter trade is found in St. Louis. In most cases the number left over from last year is small, averaging around 100 per jobber. Some are placing their

initial orders now for 300 to 400 each. The total stock on hand in St. Louis is about 2,000, and the initial orders will be for about the same amount. It is felt as a rule that this winter will be fairly cold and that good sales will prevail, but purchasing must await the actual demand. Retailers' stocks are low because of reduced price sales made at the close of last season. Their initial purchases have not been determined.

There is little prospect that Chicago jobbers will be able to place many orders with the manufacturers this fall or will be able to dispose of much of their stock to dealers. Nearly all jobbers went into the summer with from 25 per cent to 50 per cent of their normal winter requirements still on hand, and this is true of many dealers, though there are more dealers unstocked than there are jobbers. It is estimated that it will be at least the first of January before even a normal retail demand will be reflected by orders placed with manufacturers. Another consideration which will tend at that time to keep down the size of individual orders is the fact that several of the largest manufacturers of heaters either have factories or warehouses here so that jobbers can replenish their stocks at will. It is felt that unless there is a complete stabilization of prices by the first of the year this policy is apt to be generally followed.

PRICE REDUCTIONS SOUGHT IN SOUTHEAST

Southeastern jobbers were disappointed with last winter's sales, and they feel that the sales of this season will be only nominal. Price reductions are sought particularly from this quarter, compliance with which, it is felt, would bring sales that would approximate normal. Fairly heavy carry-over stocks are reported so that only from 40 to 50 per cent of last season's orders are being contracted for.

Heavy stocks of heaters in the Intermountain district were held over from last season, following a very small demand, and there is small prospect of satisfactory orders being placed with manufacturers in the immediate future. Northwest stocks too are quite heavy; some light orders are being placed, but in other quarters it is expected that present stocks will not be replaced soon.

San Francisco reports a particularly good outlook. Advance orders taken in California are shown to be higher than those taken at this time the previous year. Special efforts were made to get these orders in early and notwithstanding business conditions and considerable stocks remaining the scheme worked out well. Attention is being paid to larger heaters of both portable and stationary type, and special heavy-duty appliance campaigns have been arranged to get results. It is reported that 60,000 heaters were sold in California last season and that this season promises to see even more disposed of. Record-breaking export sales are also recorded from this state.

Number of Fans Sold in 1921 Season Runs High

THE Fan Motor Section of the Associated Manufacturers of Electrical Supplies met at Hot Springs, Va., on Sept. 8 and 9 to discuss the season just past, the season coming, standardization, concentration of sales efforts, etc. It was brought out there that the fan season of 1921 has been better than that of 1920 in number of units sold, but because of the lower price ruling this year the value of the sales may not reach so large a total as last year.

It has been a particularly good season for the trade outside of the manufacturer because the distributers, jobbers, dealers and contractors virtually have cleaned out their stocks. Starting the season with fair stocks, the trade purchased fans to a great extent in small lots during the season and has come through to September with bare shelves. It is the manufacturer who is holding the stock now. He probably has greater stocks at this time than he normally should have, but this is because the trade has nothing. The total of stock on hand in all quarters is no larger than normal.

One feature of the past season is that the sale of fans for household use showed a percentage increase of total fan sales. This is interesting in that fan manufacturers are looking toward the household market as presenting a very bright field of endeavor. It is felt that this market is less developed and less saturated than the commercial market, and special emphasis is to be placed on sales in that direction this coming season. It is found that non-oscillating fans of the smaller sizes, under 12 in., are supplying the most ready appeal to householders, and once these fans have got a foothold it is easier to sell oscillating and larger types.

Ceiling-fan business of last year seemed to be just ahead of the supply, and virtually the same condition has existed this year. The market has been strong and not always satisfied.

Fan Tax Turns in $297,583

AN ANALYSIS of the taxes collected during the fiscal year ended June 30 shows that the excise tax levied on portable electric fans resulted in the collection of $297,583.14, a decided increase over the revenue from the same source during the fiscal year of 1920, when $174,084.05 was collected. This is a 5 per cent tax paid by the manufacturer on his selling price and represents manufacturers' fan sales of approximately $6,000,000.

Metal Market Situation

SUDDEN strengthening in the price of copper last week has caused many domestic consumers to withdraw their inquiries and await further developments in the trend of the market. So far this has had little or no effect on the price. Electrolytic is being held by producers at 12.25 cents delivered, spot and September, 12.37½ cents for October and 12.50 cents for November-December. Much of the advance in the market since Sept. 1 has been based on larger export buying. Last week nearly all of the foreign orders came from Germany, and out of 3,950 tons shipped abroad from Atlantic ports in that time 3,730 tons went to Germany. That country is temporarily out of the market because of the recent drop in the exchange value of German marks. Compared with a week ago standard copper at London is lower. The market, however, is steadier and transactions few and for small quantities.

In some quarters it is thought that the advance in copper has been too rapid, as since Sept. 1 producers have advanced their asking prices ¼ cent a pound and in the outside market the rise ranged from ¼ cent to ⅜ cent a pound. Few orders have been placed by consumers at 12.25 cents delivered for prompt and September shipment, and it is claimed that this price was shaded ⅛ cent for prompt shipment of electrolytic.

The price of lead has advanced another 10 points to 4.60 cents, New York, and demand continues good. Some producers report even more activity at present than before the rise, and it is noteworthy that prompt shipment is being called for in nearly all instances.

NEW YORK METAL MARKET PRICES

	Sept. 6, 1921	Sept. 13, 1921
Copper	£ s d	£ s d
London, standard spot	68 17 6	68 17 6
	Cents per Pound	Cents per Pound
Prime Lake	12.00	12.25
Electrolytic	12.12½	12.25
Casting	11.62½	11.75
Wire base	13.50	13.50
Lead, Am. S. & R. Co. price	4.50	4.60
Antimony	4.45	4.45
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.70	4.70
Tin, Straits	27.25	26.75
Aluminum, 98 to 99 per cent	24.50	24.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.50—10.00
Brass, heavy	4.50—4.75	4.50—4.75
Brass, light	3.75—4.00	3.75—4.00
Lead, heavy	3.25—3.37½	3.37½—3.50
Zinc, old scrap	2.00—2.25	2.00—2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SEVERAL sections of the country report slightly better trade in the electrical field. No high spots have been uncovered, however. Government reports on the corn and other crops, except cotton, show record yields for corn and higher than ten-year averages for other crops. The South, consequently, is anticipating better business this fall.

In Chicago the Landis decision has given an impetus to construction plants, but the electrical trade has felt no reaction to this movement yet. Better business is reported here in high-tension switching equipment, washers, ironers and instruments. Boston shows slightly better business with increasing activity in textile, leather, and shoe trades. Wire, porcelain, line hardware, armored conductor and motors under 50 hp. are quite active.

Increasing orders in the wiring supply field are reported in New York since Labor Day, but most of it seems to come from outlying centers. Trade is holding up well. St. Louis shows small improvement. Building is a little better and meters and distribution transformers are moving fairly well. On the West Coast building is more active in San Francisco, and exports from Seattle and Portland are increasing. Business is taking on a better tone there.

NEW YORK

Trade held up well during the past week, and jobbers generally expressed the opinion that dealers and contractors are buying with more confidence than heretofore. The firmer undertone to business as reported last week continues, and since Labor Day there has been a noticeable increase in orders for wiring supplies. This demand is coming chiefly from out-of-town dealers and indicates activity in the building of homes. Heating appliances are moving at about the same rate, and jobbers state that the trade has not yet placed any orders for holiday stock. It is stated that some dealers expect a further drop in prices of these appliances and for that reason are holding off. However, manufacturers have signified no intention of a downward revision of prices.

While business is showing considerable improvement, jobbers state that competition is very keen and price cutting is in evidence The wire market has been unsteady and prices vary over quite a range. Stocks in many instances are long and jobbers state that the situation has been aggravated by dealers being able to purchase wire from manufacturers in comparatively small quantities at prices below those which can be quoted by jobbers.

Collections are showing some improvement. Current billings are running thirty to sixty days, and the large accounts which have been outstanding for some time present the most difficulty. The latter are being whittled down gradually, and electrical credit men feel that conditions are becoming much better.

Conduit.—Little change in the price of conduit was reported this week. The following prices were quoted: For ½-in. black pipe in 2,500-ft. lots, $54 to $55; ¾-in., $71 to $74.52, and 1-in., $104 to $106.76. Galvanized pipe in the same sizes was quoted as follows: $59 to $62.73, $77 to $81.42 and $116.96. It will be noticed that the above prices for some sizes are slightly lower than the last previous quotation; however, there has been no announcement of a general reduction. Demand is slightly better, but orders continue to be of small to moderate size.

Flexible Armored Conductor. — The demand continues steadily with most buying of a hand-to-mouth nature. Prices remain about as last quoted: $44.50 per 1,000 ft. for No. 14 two-wire, single-strip, in 1,000-ft. lots.

Rubber-Covered Wire.—There is little stability to the wire market at this time, and jobbers state that quotations are only nominal. No. 14 rubber-covered in 5,000-ft. lots is quoted at $6 to $6.25 per 1,000 ft. It has been reported that some sales at $5.85 per 1,000 ft. have been made. Jobbers stocks are good to large.

Loom.—Demand is light in this territory and stocks are kept low accordingly. The increase in price of cotton last week has affected this material, and the $\frac{7}{32}$-in. size is quoted this week at $19.25 to $19.80 and the ¼-in. size at $21 to $21.60.

Lamp Cord.—The demand is light and some jobbers report large stocks on hand. Prices quoted this week are for No. 18 cotton-twisted $11 per 1,000 ft. and for No. 18 parallel $14.60 per 1,000 ft.

Schedule Material.—The new discounts on certain items as reported last week have caused a drop of about 25 per cent in the prices of the material affected. Discounts to the trade for standard-package lots range from 40 to 45 per cent. Most jobbers' stocks are small, but ample to meet the present demand.

CHICAGO

The outstanding feature of the week has been the decision of Judge Landis in the building wage controversy and the impetus it has given to plans for construction. There is considerable dissatisfaction among the trades affected by the wage cut, but this was expected and it is thought will not last long. The electrical workers, whose pay was cut from $1.25 to $1.10 per hour, were among the first to accept the decision formally. The decreases average about 15 per cent, and according to prominent architects this, in conjunction with lower material prices, makes construction approximately 25 per cent cheaper than on Sept. 1, 1920.

Electrical jobbers and manufacturers report a quiet week as far as sales are concerned while there has been virtually no change in price levels. Makers of high-tension switching and protective equipment report business picking up, inquiries from the agricultural districts having come in recently and a number of foreign orders having been placed. Retail business is improving, the main cause being the slightly better movement of washing machines and ironers following the recent price cut. Collections remain at from fifty to sixty days, which may be considered comparatively good.

Rigid Conduit.—Sales are fairly numerous but individually small so that total demand may be considered rather slack. September and October should see a good movement of this item, as contractor-dealers expect a number of jobs to mature during those months and they are not heavily stocked. Card 47 is still in effect, a representative quotation being $55 per 1,000 ft. of ¾-in. black.

Meters.—Demand outside of Chicago has become slightly more active, but the farmers are not buying normally yet. The Sanitary District of Chicago, the main local customer, has done no purchasing for some time.

Instruments.—Sales of measuring instruments each month since January have bettered those of the preceding month. At present orders are fairly numerous, but the customers who bought in large lots eighteen months ago are buying now in lots of one and two instruments.

Tape.—The flurries of the cotton market were closely watched by jobbers here in the event that tape prices should be bolstered up by an advance in cotton prices. Large stocks are on hand here, and the quotation of 35 cents per pound on friction tape is purely nominal, as a large purchaser could virtually make the price himself. Rubber tape is firmer at 38 cents per pound, but demand is equally quiet.

House-Wiring Materials.—The Landis decision has not reacted on this line of supplies as yet, and contractor-dealers continue to buy for their immediate needs only. Jobbers' stocks are good, and for a time they will be able to make immediate delivery on nearly all items if demand picks up.

BOSTON

Business reflects slowly improving conditions in the New England electrical field. A healthy revival of activity continues in the textile, shoe and leather industries. Metal-working industries are still dull, and in the building field operations are only moderate in volume. Building and engineering contracts in New England for the week ended Sept. 6 totaled $3,333,400, a better showing than in many earlier weeks in the current year, but still considerably below 1920. The paper industry is improving, though slowly. Electrical jobbers' stocks are still being reduced slowly. Prices are unsettled in porcelain products. Collections are not quite so satisfactory as they were a fortnight ago, sixty days being a common term. Vigorous activity in the washing-machine market is evident in some quarters, following recent price reductions. Informal reports of improving industrial conditions were current at the thirteenth annual convention of the New England Division, N. E. L. A., held last week at New London, Conn., central-station twenty-four-hour outputs being close to or in excess of those of last year in not a few instances.

Wire.—Better movement in wire is reported, weatherproof No. 6 selling at 15 cents per pound up to 500 lb. and at 14½ cents in larger quantities. Rubber-covered wire is also stirring more actively, sales at $6.00 per 1,000 ft. in 5,000-ft. lots being representative. Some jobbing interests expect an upward trend in weatherproof, owing to the recent advance in cotton price.

Motors.—Moderate improvement is noted, with well-maintained inquiries and widely distributed sales. Sizes under 50 hp. appear most in demand, and a representative distributer stated Monday that the textile and leather fields were displaying the most interest in this class of equipment.

Washing Machines.—A revival of buying has been noted in some quarters, probably as a result of recent price changes and active sales effort. A Massachusetts factory has reopened with rush orders, offering employment to 1,200 workers.

Flexible Armored Conductor.—Quickened movement is apparent, though current stocks are not being lowered very fast. No. 14 in 5,000-ft. lots sold around $50 per 1,000 ft. at Boston Monday.

Porcelain Material.—Increased activity by contractors is moving more of this class of supplies. "Nail-it" knobs, in good stock, are selling at $14 per 1,000 in barrel lots and 3-in. tubes, ⅞-in. diameter, at $4.60 per 1,000 in barrel lots. It is stated that recent increases in factory prices have not yet been applied by jobbers.

Pole-Line Hardware.—This class of material is selling better of late owing to the carrying out of deferred construction by central-station companies on at least a moderate scale. Price movements have also stimulated buying somewhat, though nothing like rush business is reported.

Steel Fish Tape.—Prices are off, ½-in. x ⅛-in. selling at $2 list per 100 ft., with the following discounts: Less than 500 ft., 10 per cent against list before the cut; 500 ft. to 1,000 ft., 25 per cent off against a former 5 per cent; 1,000 ft. and over, 33⅓ per cent against 10 per cent previously. Tinned pipe straps are down 19 to 16 cents per pound on 25-lb. to 100-lb. lots.

ATLANTA

The sensational rise in the price of cotton and the beneficial effect that will accrue to all lines of business in this section has served temporarily to place the consideration of all other subjects in the background. It is the general opinion that bankers and merchants who have long carried their clients will insist upon their borrowers liquidating their debts, thus forcing the sale of the staple at and around 20 cents, and it is generally expected that cotton will settle to a 19-cent base. The government crop report for Sept. 1 has just been released and predicts the largest corn yield for Georgia on record, while the condition percentage of all other crops, cotton excepted, is well above the ten-year average. This, together with the fact that Georgia will realize $100,000,000 from this year's cotton crop, has gone a long way toward insuring the elimination of frozen credits in the rural districts and is lending a most excellent tone to business in general. The direct effect is not yet in evidence as little of the fall crops is as yet on the market, but most lines of business are anticipating the effects of the condition noted above and are making their plans accordingly. The textile trade in particular is very active, nearly all mills being back on the full-time basis, and some inquiries are being received for new construction and for additions to mills.

Lamps.—The demand for large incandescent lamps appears to be increasing with the advent of the fall season. Stocks are in excellent shape.

Schedule Material.—The market is very unstable. There is a general scramble for orders when business is in sight, and as a result no stable market quotations are available. Sockets and rosettes continue to be most in demand. Prices were off approximately 25 per cent last week.

Lock Nuts and Bushings.—The line continues to move steadily, with heavy stocks on hand. A price reduction of 15 per cent was announced last week.

Portable Lighting Fixtures.—Indications point to a very good business in portables this fall, dealers and jobbers anticipating increased sales because of the many new homes being erected. No large orders are being placed with factories so far as jobbers are watching the market carefully. Stocks of the various types are low.

Fans.—The hot wave of the last two weeks has tended to stimulate the sales of fans to a greater extent than has been experienced for the past two or three years at this period of the year.

Motors.—There has been comparatively little call for the fractional sizes, and the market has been sporadic for the larger sizes. However, some substantial sales have been made in the units of 250 hp. and above.

Arresters.—The demand for arresters has been very good throughout the summer and was much better than expected. Present-day sales are fairly satisfactory. Stocks on the 2,300-volt type and below are in excellent shape.

Sewing Machines.—Following the condition of the market of almost all electric appliances, the sales of sewing machines have been very light with the exception of those cases where special campaigns have been put on. In a number of instances prices have been cut in half to move the heavy stocks. On the whole, however, jobbers have been fortunate in not having large stocks on hand.

ST. LOUIS

Improvement in business, though small, was nevertheless definite, as experienced by the St. Louis jobbers last week. Demand for appliances was substantially better and increased interest was noticed in meters, transformers and other equipment for use in small distribution extensions. Demand for wiring supplies showed no appreciable improvement, for building work continues fairly dull. The sudden and marked improvement in the cotton market has been keenly watched here, for if the higher market continues, better business in St. Louis is virtually assured, a large portion of the trade of both manufacturing and commercial establishments being obtained from the Southern States. However, it was too early for any effect to be noticed in last week's business.

Building permits for construction and repairs in St. Louis show a small increase. Since the first of the year the values of the monthly permits have been: January, $333,025; February, $714,845; March, $974,405; April, $1,127,155; May, $1,087,195; June, $2,150,069; July, $1,118,215; August, $1,307,206. The principal portion is for residential work. A considerable amount of construction work, both industrial and residential, has been done in suburban St. Louis but is not included in the above figures.

Money is becoming easier, improvement being particularly noted in the South. Collections, however, continue to be on a basis of forty-five to sixty days. Generally speaking, stocks have been well liquidated, it being only in a few cases that overstocks of any item are found.

Wire.—Slightly easier prices are found, No. 14 rubber-covered being quoted at $6.10 per 1,000 ft. in 5,000-ft. lots, a reduction of about 30 cents. The base price on both bare and weatherproof is being made at 14 cents per pound, a reduction of about 1 cent. Some report slightly better movement, but the general demand is unchanged.

Schedule Material.—Recessions in prices ranging from 20 to 25 per cent are announced in certain lines, some of which are sockets, rosettes, fuse plugs and certain receptacles. New prices on sockets, in standard-package lots, are: Key, $10 per 100; keyless, $18.50; pull, $36. Plug fuses are priced at $2.75 per 100 in lots of 500. Demand is slow except for the fuses, which have maintained fairly steady sales. Stocks as a rule are in line, but there are a few instances of overstock in rosettes and receptacles.

Insulators.—There was some fluctuation in the price of porcelain insulators during the week, but the old levels now prevail. There has been some improvement in demand from the utilities for small-order lots. Deliveries can now be given with reasonable promptness.

Pliers.—Owing to the comparatively quiet market, stocks have been brought to about a normal basis and good deliveries can be had from the factories. Prevailing prices on Klein's side cutters are: 5-in., $2.60; 6-in., $2.80; 7-in., $3.25; 8-in., $3.75; 9-in., $4.45.

Poles.—Improved buying on the part of utility companies for small extensions continues. Prices in car-load lots, f.o.b. St. Louis, are, for 7-in.-top Northern white cedar: 35-ft., $16.25; 40-ft., $20.90; 45-ft., $25.05; 50-ft., $31.20. Corresponding prices on Western red are: 35-ft., $11.70; 40-ft., $13.90; 45-ft., $18.70; 50-ft., $22.10.

Storage Batteries.—A fairly good business has been existing for some time, but further improvement has been noted the past few weeks, particularly for automobiles. One jobber reports business as being 50 per cent higher than last month, owing to his manufacturer bringing out a lower-priced battery.

SAN FRANCISCO

The building strike is definitely past, and all jobs both large and small are now proceeding under the American plan. Increased retail business is reported from all sections except possibly the Mission, where live most of the men who have been out during the sixteen weeks of the strike. Many dealers are now quoting a labor charge of $1.75 per hour instead of the $2 formerly charged. The railroads have petitioned the Interstate Commerce Commission to restore the former Pacific Coast terminal rates which were removed when the Panama Canal was closed to commercial traffic during the war. A very comprehensive commercial survey of San Francisco is now being scientifically made to prepare for the expected industrial increase. Factory sites are being plotted and the boosting campaign will be supported by actual knowledge, affording real information and assistance for those attracted by it. An exceedingly long petition asking it to electrify its suburban lines as far as San José, 50 miles from San Francisco, has been presented to the Southern Pacific Railroad Company by residents along its present steam right-of-way.

Schedule Material.—In accordance with the intention to make low prices for smaller lots than were needful in the past, single-pole, 10-amp. push switches are being sold in lots of 100 for 38½ cents each and three-way push switches of the same type for 60 cents each, which was the former price for lots of 500. Local stocks are good and a much better movement is being reported.

Knife Switches.—Protective knife switches, in accordance with the California state regulations, are experiencing specially keen competition. The sale of double-throw switches is also increasing because of the interest in ranges and water heaters.

Farm Plants.—All business dealing directly with farmers and growers has been rather poor all year because of a certain pessimism on their part, but during July and August an increasing business in farm plants was manifest because of the sale of crops. An unusually large number of these plants are now being sold on time payment.

Washers.—Many of the standard makes have dropped so that the prevailing market price runs from about $135 to $140, an average decrease of approximately $25. The washer market is still rather poor, but it is expected that this sharp decrease will have a more beneficial effect upon the buying public than several small decreases.

SEATTLE—PORTLAND

The general tone of business reports continues to be optimistic, although actual volume may not have increased very materially. The business men of Seattle who were the most pessimistic a month ago now admit that conditions are actually somewhat improved, and it is generally felt that further improvement, although slow, will continue during the coming months. While lumber men report that business is not satisfactory, yet they state that the prospect looks much better than it has for some time past. Lumber production for the last week was about 70 per cent of normal. There is a general increased activity in nearly all industrial lines in the Portland district, and a large local woolen mill will soon be operating at full capacity. In Seattle it is reported that a local branch of a large mail order house has increased its sales 25 per cent in the last ten days.

Import and export business for the port of Seattle in July showed an increase of 34.9 per cent over the low month of May, and it is expected that August in turn will show an increase over July. Custom House reports for the year ended June 30, 1921, show that Portland's exports increased more than 60 per cent over the same period for 1920. Grain exports are increasing very rapidly.

A slight increase in employment is noted throughout the Northwest. Wages are still being revised downward, and an effort is being made to reduce the tax burden.

Electrical jobbers of Seattle report inquiries picking up and business slowly improving. Portland jobbers report sweeping price reductions varying from 10 to 50 per cent on schedule material, while in Seattle declines of 20 per cent in standard light sockets and a like amount in snap switches have gone into effect this week. Feeling that prices have reached the bottom, Portland jobbers' stocks are now being carried on about a four-month basis. Shipments are coming through in from two to three weeks' time. Credits are loosening somewhat and collections are improving slightly. The average length of time in the electrical trade for August was forty-eight days. Seattle reports collections still hanging around forty-five days, and little improvement if any is noted in credits.

SALT LAKE CITY—DENVER

The past week has not recorded any significant changes in the financial and industrial status. Buying is slow in most lines and little electrical merchandise is moving to the ultimate consumer. Dealers are not stocking heavily, while jobbers are well prepared to meet any demands that might arise. The price tendency on electrical merchandise is downward, and slowly but surely factory prices are creeping downward toward the level that will meet with buyers' response. Jobbers and dealers are following the policy of giving the ultimate buyer full advantage of price cuts. There is an eagerness shown to break the deadlock that now exists and to get money more freely in circulation. Collections are about as slow as ever, and banks have not changed much in the policy of ultra conservatism. While there have been no material rate concessions to relieve the shipment of crops, farmers are harvesting big yields and taking extremely low prices on most products.

Washers.—Dealers are advertising a small reduction on several makes of washers, amounting to about $10 on the dolly type and $20 on the cylinder and oscillating types. Sales are not at all brisk.

Line Transmission.—A little activity has been noted in line construction, which has called for considerable equipment. The jobs are not large but the showing is looked upon as a hopeful sign.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Atlantic Division Jobbers' Meeting Postponed

By direction of the division chairman, George L. Patterson, the meeting of the Atlantic division of the Electrical Supply Jobbers' Association, called for Sept. 22, has been postponed to Oct. 20, at the Bellevue-Stratford, Philadelphia. This action was prompted by the fact that, because of other plans and engagements, many members of the division found it impossible to be in Philadelphia on Sept. 22, and it was deemed wise to postpone the meeting until such time as a full attendance could be expected.

Publication of Engineering Data Urged

Prof. Arthur M. Greene, Jr., new dean of Princeton College of Engineering and chairman of the research committee of the American Society of Mechanical Engineers, in an address to the engineering profession, through the official journal of the society, urges the need for research. He points out that surprising facts have been revealed, for instance, by the report of the committee on elimination of waste in industry of the American Engineering Council, organized by Herbert Hoover. Mechanical engineers should be willing to give their data to the profession after they have used them for development work, Professor Greene says. "Many data," he says, "are buried where they are doing no work, and their publication would not damage our business and would help the profession."

Credit Features of Mexican Locomotive Orders

One of the interesting features of the locomotive orders which the Baldwin Locomotive Works of Philadelphia has taken during the last three months for various interests in Mexico is the terms of credit allowed. Ninety-eight locomotives are included in these orders, aggregating about $5,000,000. The most recent of these orders were for sixty-five locomotives and were negotiated with Obregon by Samuel M. Vauclain, president of the works during his recent trip to Mexico.

The Mexican National Railways, it is reported, has taken eighty-three of the locomotives, on all of which credit is extended. The greatest length of time is three years and covers forty-five locomotives at a cost of $2,000,000. Monthly payments are to be made on this contract for thirty-six months, with interest. A further credit of $500,000 is in fact a loan made to Mexico by the company, to be expended in repairs.

A further credit of $2,500,000 is still under negotiation between Mr. Vauclain and the Mexican officials. On another railway order credit is being extended to cover the payment for eleven locomotives, the cost of one locomotive being liquidated each month. A Mexican oil company is paying cash for four locomotives.

About $8,000,000 worth of business is on the books of the Baldwin Locomotive Company at this time, about evenly divided between domestic and foreign business; but at that the plant is operating at only about 30 per cent capacity. From the amount of Mexican business being taken, however, it would seem as though a revival in industry were under way.

Heine Boiler Company Drops the Word "Safety"

The Heine Boiler Company, St. Louis, is the new name of what was formerly the Heine Safety Boiler Company. No change in financial interest or management was made. The company has purchased additional ground adjacent to its present property and contemplates expansion of its facilities when it feels that building costs warrant new construction.

Apex Adds Ironer to Washer and Cleaner Line

The Apex Electrical Manufacturing Company, Cleveland, announces the adoption of the former Gould electric ironer, which is now being manufactured in its three-acre Apex-Rotapex plant. This machine rounds out the line of major household electrical appliance units and so far is traveling under no particular name. The ironer, however, has been on the market for about a year.

Equitable Equipment Company Formed in New Orleans

O. D. Cleveland announces that he has formed the Equitable Equipment Company, 411 Whitney Central Building, New Orleans, La. Mr. Cleveland was formerly manager of the New Orleans branch office of the General Equipment Company, 30 Church Street, New York City. The new company handles hoisting and construction equipment, boilers, engines, mill supplies, pumps, electrical equipment, air compressors, line shafting, pulleys, link chain, etc.

Wire Building Plant Going Up on West Coast

The California Wire Company, Orange, Cal., announces that it is engaged in building a plant for the manufacture of insulated wires, the first department being a weather-proof wire plant which the company expects to have in operation some time in October.

Louis Koth is president of the company, Fred A. Grote is secretary and treasurer, and Fred H. Alden is sales manager. Mr. Koth was formerly president and Mr. Alden was formerly secretary, treasurer and sales manager of the Illinois Wire & Cable Company, Sycamore, Ill.

The company feels a great deal of confidence in the field offered for wire manufacture on the Pacific Coast, not only for domestic business but also for export business.

Jawitz Electric Motor Established in New Quarters

The Jawitz Electric Motor Company, motor dealer, has removed its plant from 236 Canal Street to 211 Center Street and 147 Lafayette Street, where it has more spacious quarters. The increased facilities will enable the company to handle a larger stock of motors, generators, plating generators, electric drills, grinders, etc.

U. S. Light & Heat Reducing Expenses to Increase Profits

In the company's report for the year ended Dec. 31, 1920, C. O. Mininger, president of the United States Light & Heat Corporation, Buffalo, N. Y., shows that through reduction of overhead and an increase in sales effort the company's business for the first six months of the present year has shown an increasing profit each month. The report has just been issued.

"The management of the business passed into the hands of the present officers on Feb. 7, 1921," said Mr. Mininger. "During the five months preceding this date the company operated at a loss of $296,831, or an average of approximately $60,000 a month. The first attention of the present management was given to correcting the conditions that had created these losses, and there was immediately inaugurated a readjustment of salaries and an elimination of operating expenses wherever possible, and reductions totaling approximately $40,000 a month were made in overhead operating expenses in the executive and manufacturing departments."

Further attention was given to obtaining additional business such that with sufficient volume and reduced operating expenses the result would show a profit. The profit for March was $3,187, and each succeeding month showed an increase through June which stood at $35,847. A considerable part of June's profit, however, resulted from the price at which bonds secured by

first mortgage on the company's property were retired.

"As an indication of what has been accomplished," Mr. Mininger said, "it may be stated that in May, 1920, sales of $577,957 resulted in a loss of $10,644, whereas in May, 1921, sales of $346,787 resulted in a profit of $22,816. Every endeavor is being made both in stimulation of sales and the introduction of economies to continue the operation of the company at a profit each month even under present business conditions. While, of course, the volume of business that will be received for the next few months cannot be predicted with certainty, it has been demonstrated that any return to normal times will result in substantial profit.

"The conditions resulting from the radical change in operation expenses above set forth have placed the company where it is assured of continuing to operate without concern as to its finances. It is confidently expected that the next report will show even greater improvement."

During the year 1920 the company added buildings and equipment to the value of $721,374. While the automobile trade supplies a great part of its market, a good share is found in the field of batteries for farm-lighting sets, train-lighting equipment, electric welders, etc.

Pump Manufacturers to Meet to Consider Organization of Entire Industry

At the conference that was called by the Department of Commerce last month Secretary Hoover indicated a desire that the entire pump industry be organized, and it was agreed that committees should be appointed by the Hydraulic Society and by the Compressed Air Society to co-operate with the government and work out plans for mutual benefit and service.

The president of the Hydraulic Society and its plan and scope committee have decided, consequently, to call a meeting at the Drake Hotel in Chicago on Sept. 26, to which meeting have been invited the members of the Compressed Air Society, all non-member manufacturers of hydraulic pumps and air compressors, and all manufacturers of windmills, hand pumps, spray pumps and pneumatic pumps whose names could be ascertained by C. H. Rohrbach, 50 Church Street, New York City, secretary of the two societies named above.

The principal business of the meeting will be to work out some plan of organization for the entire pump industry as desired by the government which will be satisfactory to all of the various interests.

Secretary Rohrbach has sent letters of invitation to approximately twenty-one air-compressor manufacturers, seventy-one hydraulic and centrifugal pump makers, thirty-six hand-pump makers, thirty-three pneumatic, sixty-six spray and nineteen windmill pump manufacturers, a total of approximately 246 manufacturers of all kinds of pumps, and to date has received replies so favorable as to indicate that much interest is taken by these companies in the movement for co-operation fostered by Secretary Hoover.

"United States Radium Corporation" New Name for "Undark" Manufacturer

The United States Radium Corporation, 58 Pine Street, New York City, is the new name which has been taken by the former Radium Luminous Material Company, manufacturer of "Undark" luminous material for push-button switches, pull switches, etc. The change became effective Sept. 1, but no change was made in control, management or any other condition. Because of the extent to which this company has gone into the medical field in its employment of radium it was felt that the old name did not adequately cover the company's activities.

The Remy Electric Company's plant at Anderson, Ind., which has been closed down, has resumed operation with a force of 950 employees.

The George J. Hagan Company, Pittsburgh, manufacturer of electric furnaces for both low-temperature and high-temperature work, has appointed the Clarkson Specialty Company, 1205 Olive Street, St. Louis, as its representative in the St. Louis territory.

The Metal Coating Company of America, manufacturer and distributers of the Schoop metal-spraying process, by means of which metallic coatings may be sprayed on any surface, is now in full operation at its new plant, 495-497 North Third Street, Philadelphia, having removed from its former Boston (Mass.) and Woonsocket (R. I.) locations.

The Elliott Company, Pittsburgh, has removed its Philadelphia district office from the Pennsylvania Building to 812 Morris Building. T. F. Crawford is in charge of the Philadelphia office. In addition to the business of the Elliott Company this office also handles the Philadelphia territory for the Liberty Manufacturing Company, Pittsburgh, and the Lagonda Manufacturing Company, Springfield, Ohio.

The Rutenber Electric Company, Marion, Ind., is opening a sales office at 154 West Lake Street, Chicago, in charge of Herbert H. Frost and H. E. Willmore, experienced heating-device salesmen and engineers, to enable the factory to maintain closer touch with the Chicago territory.

Ajax Electric Specialty Company, 1011 Market Street, St. Louis, importer and manufacturer of electrical specialties, has made arrangements with the I. A. Bennett Company, 112 West Adams Street, Chicago, to act as its exclusive district sales representative for Indiana, Illinois, Wisconsin, Minnesota, North Dakota, South Dakota and the upper peninsula of Michigan.

Foreign Trade Notes

SCHEME TO HARNESS TIDES IN FRANCE.—A detailed scheme to harness the tides of the sea to generate electricity, according to the *Matin*, has been submitted by a committee that has been engaged for two years in study on the subject to M. le Trocquer, Minister of Public Works, who has decided to proceed at once with the necessary investigations. The experimental power station is to be established in Brittany, in Aber-Vrach Bay. A dam 150 m. (492 ft.) in length will be built, and the water inclosed therein will be used to put in motion the turbine engines. It is estimated that 4,800 hp. can be developed by this means.

IMPROVEMENTS PROPOSED FOR PALESTINE.—The government of Palestine, according to Julian E. Gillespie, assistant trade commissioner, who has just completed a visit to Egypt, Syria, Palestine and Smyrna, is considering an enlargement of the ports of Jaffa and Haifa, the erection of a large water-power plant sufficient to meet the needs of all Palestine, the irrigation of the Jordan Valley, and the construction of a railroad from the Sea of Galilee directly east to connect with the Bagdad railway. Improvement to the port at Jaffa is probably all that will be accomplished in the near future.

ELECTRIFICATION PROJECTS IN CZECHOSLOVAKIA.—A plan has been submitted to the Ministry of Public Works, according to one of the newspapers of Prague, for the construction of a dam 70 m. (230 ft.) high at Stechovice 30 km. (18 miles) south of Prague. The proposed dam, it is estimated, would cost between 250,000,000 and 300,000,000 Czechoslovak crowns (1 crown=1⅛ cents) and would develop about 250,000 kw.-hr. of electricity per year.

PROPOSED EXTENSIONS TO EDINBURGH ELECTRIC PLANT.—Extensions are contemplated to the municipal electric plant of the Corporation of Edinburgh, Scotland, involving an expenditure of about £1,068,000, chiefly in connection with the new station at Portobello.

HYDRO-ELECTRIC PROJECT ON RIVER RHONE.—The legislation affecting the proposed combined hydro-electric, irrigation and navigation scheme for the River Rhone, according to reports from Consul Carrigan at Lyons, France, has been passed. The report states that this is simply the putting into legal form of the general plan embracing the principles of the project and the outlining of a scheme of organization, leaving the details to be handled by concessioners.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A manufacturing firm in Spain (No. 9) is considering the construction of a brewery and wishes to receive catalogs of brewery machinery, electrically operated, with a capacity of 3,000 bottles per hour.

A merchant in the Dutch East Indies (No. 16) desires to purchase and secure an agency for the sale of small refrigerating units for houses, hotels and stores.

A commercial agent in Europe (No. 26) desires to purchase for an Eastern European government copper ingots of 150 to 200 metric tons, suitable for electrical use.

A commercial agent in Italy (No. 35,403) desires to secure an exclusive agency for the sale in Sicily of electrical supplies and materials of all kinds, including motors.

EQUIPMENT FOR MANGAHAO (NEW ZEALAND) POWER SCHEME.—Tenders will be received by the Public Works Department of New Zealand, addressed to the Secretary, Public Works Tenders Board, Wellington, New Zealand, until Nov. 29, for furnishing equipment required for the Mangahao electric power scheme as follows: Three waterwheels of 6,450 b.hp., and two waterwheels of 3,225 b.hp., complete with governors, couplings and accessories; three 6,000-kva. and two 3,000-kva. alternating-current generators; two three-unit exciter sets, each consisting of one 375-b.hp. Pelton wheel, one 250-kw., direct-current generator and one 350-hp. synchronous motor; seven

4,000-kva., single-phase transformers and accessories; insulators for 110,000-volt, 50-cycle transmission lines; lightning arresters for operation on two 110,000-volt, three-phase transmission lines; switchboard, switches and accessories. Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street, S.W. 1, London, England.

ELECTRIC EQUIPMENT FOR SAN SALVADOR.—Rafael Lima, chief engineer of the Electric Light & Power Company, San Salvador, Salvador, Central America, would like to receive catalogs of electrical equipment, including lamps, meters, switchboards, plugs, machinery and general supplies, etc.

MACHINERY FOR ELECTRIC PLANT FOR WELLINGTON, NEW ZEALAND.—Tenders will be received by the Wellington City Corporation, addressed to Preece, Cardew & Rider, 8 Queen Anne's Gate, Westminster, S.W. 1, London, England, until Oct. 13, for furnishing and erecting the following equipment: (A) Two water-tube boilers with feed-water heaters, superheaters, stokers, etc.; (B) one 5,000-kw. turbo-alternator, with condensing plant. Specifications and form of tender may be obtained from Preece, Cardew & Rider, 8 Queen Anne's Gate, Westminster, S.W. 1, on payment of £2, which will be returned on receipt of a tender

New Apparatus and Publications

BALL BEARINGS. — The Norma Company of America, Long Island City, N. Y., is distributing a folder "Norma Precision Ball Bearings in Lighting Generators."

IRONING MACHINE.—The Apex Electrical Manufacturing Company, Cleveland, is marketing the former Gould electric ironer, a publication on which it is distributing.

ELECTRIC DRILL.—The Elecyto-Magnetic Tool Company, Chicago, has developed and placed on the market a ¼-in. drill which may be used as a drill press by attaching to a portable stand.

LIGHTING.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is distributing a booklet on the use of its indirect light adapter for art lamps, entitled "Perfect Lighting for the Home."

REFLECTORS AND LAMPS.—The National X-Ray Company, 235 West Jackson Boulevard, Chicago, has developed and placed on the market three new products, including a showcase light and reflector, an indirect-lighting art-lamp adapter and a portable floodlamp with color effects for automobile salesrooms.

X-RAY LIGHTING APPARATUS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has issued catalog No. 22, covering its X-Ray direct lighting products, including show-window lighting and fittings, showcase lighting, industrial lighting and floodlighting. The company is also distributing a booklet entitled "Wrigley Building, Chicago, Ill."

PULLEY-SOCKET REFLECTOR. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market a new "Cutter" pulley-socket reflector.

CABLEWAY.—The Railway & Industrial Engineering Company, Greensburg, Pa., has developed a new rocking cable way for handling materials.

METAL-SPRAYING PROCESS. — "The Schoop Metal Spraying Process" is the title of a sixteen-page booklet distributed by the Metal Coating Company of America, 495 North Third Street, Philadelphia, describing the Schoop process for coating metal surfaces.

CONDENSERS.—The Wheeler Condenser & Engineering Company, Carteret, N. J., has issued a new catalog entitled "Wheeler Condensers," covering its complete line of condensers and accessories for stationary and marine service.

ELECTRIC PORTABLE DRILL. — The Cincinnati Electrical Tool Company, Cincinnati, has recently placed on the market a new ¼-in. pistol-grip portable electric drill.

LIGHTING PLANTS. — The Albert F. Hauss Company, 4 West Third Street, Cincinnati, has placed on the market a new line of lighting plants, known as the "Hauss-System," in sizes of ½ kw., ¾ kw., 1 kw. and up.

WASHING MACHINE.—The Upton Machine Company, St. Joseph, Mich., has developed a semi-cabinet type electric washing machine operating on the oscillating cylinder principle.

GENERATING UNIT. — The Kewanee Private Utilities Company, Kewanee, Ill., has recently placed on the market a direct-lighting or battery-charging generating set with an automobile-type engine.

VENTILATING FAN. — A ventilating fan, the "Marathon O.K.," has recently been placed on the market by the Marathon Electric Manufacturing Company, Wausau, Wis.

LIGHT AND POWER PLANT. — An automatic lighting and power plant having a capacity of 1 kw. at 110 volts has recently been brought out by the Instanto Electric Company, Maysville, Ky.

AUTOMATIC VALVE.—The Dual Automatic Valve Company, Rock Island, Ill., is distributing a folder entitled "How to Have Automatic Hard and Soft Water Service with One Pump," in which it describes the "Dual" automatic valve.

HEAVY-DUTY GRINDER. — The Van Dorn Electric Tool Company, Cleveland, has recently put on the market an improved heavy-duty ball-bearing electric grinder driven by a 4-hp. motor.

CIRCUIT EXTENDER.—The M. Propp Company, 524 Broadway, New York City, has developed a new device, known as a "circuit extender, which allows a number of sets of Christmas tree lights to be attached to a single circuit. It can also be used for connecting floor and table lamps and household appliances, etc.

TAP SOCKET. — The E. H. Freeman Electric Company, Inc., 803 East State Street, Trenton, N. J., has recently placed on the market a pull-chain current tap socket designated as No. 680.

CHRISTMAS TREE LIGHTING OUTFIT.—The Deal Electric Company, Inc., 81 Grand Street, New York City, has placed on the market a christmas tree lighting outfit with tapping block for connecting several sets.

ICE-CREAM FREEZER.—An ice-cream freezer equipped with a direct-connected motor has been placed on the market by Walter S. Edmands, 25 Pearl Street, Boston,

COOKER AND HEATER.—The Faraday Company, 746 Chapel Street, New Haven, Conn., is marketing a small electric cooker under the name of "Kookerette." It may be attached to an ordinary lamp socket and may also be used as an auxiliary heater.

New Incorporations

SAMUEL KLINE, INC., Trenton, N. J., has been incorporated with a capital of $25,000 to manufacture and deal in electrical specialties. The incorporators are Samuel Kline and Laurence S. Harrison.

THE MAPLE SPRINGS POWER COMPANY, Salt Lake City, Utah, has been incorporated with a capital stock of $50,000 for the purpose of operating an electric power plant, etc. The officers are M. Beauregard, Gunnison, president; L. E. Cluff, Salt Lake City, vice-president; H. R. Waldo, Salt Lake City, secretary and treasurer.

THE RYSER STORAGE BATTERY COMPANY, Louisville, Ky., has been incorporated with a capital stock of $45,000 by O. M. Ryser and O. W. Samuels.

THE BEACON LIGHTING FIXTURE COMPANY, New York, N. Y., has been incorporated by L. E. McMahon, E. A. Reilly and M. Ravitch. The company is capitalized at $10,000 and proposes to manufacture electrical fixtures and kindred equipment. O'Brien, Malevinsky and Driscoll, 1482 Broadway, represent the company.

THE BLOOM-HARPER COMPANY, Williamsport, Pa., has been incorporated with a capital stock of $15,000 to manufacture electrical supplies. A. N. Bloom, Williamsport, is treasurer.

THE SCHIMMEL ELECTRIC SUPPLY COMPANY, Philadelphia, Pa., has been chartered with a capital stock of $330,000 to manufacture and deal in electrical supplies. L. D. Schimmel, 318 Market Street, is treasurer.

THE STRONGHEART BATTERY PLATE MANUFACTURING COMPANY, Rochester, N. Y., has been incorporated by B. R. Sherman, H. Leshner and F. Wiedman, E. & B. Building, to manufacture electric storage batteries. The company is capitalized at $15,000.

THE MORTON ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been incorporated by E. R. May, T. Hansen and J. C. Humphrey. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical supplies. Hansen & Dreeben, 50 Broad Street, represent the company.

THE UNITED LAMP MANUFACTURERS' ASSOCIATION, New York, N. Y., has been incorporated by H. Wolff, R. Press and S. Math to manufacture electric lamps, etc. The company is capitalized at $75,000. E. Hollander, 8 Bline Avenue, Union, N. J., represents the company.

THE BARRY ELECTRIC COMPANY, Allentown, Pa., has been chartered with a capital stock of $5,000 to manufacture and deal in electrical equipment. C. M. Walter, Allentown, is treasurer.

THE H. C. WHITE ELECTRIC COMPANY, 119 South Neil Street, Champaign, Ill., has been incorporated with a capital stock of $20,000 to manufacture and deal in electrical apparatus. The incorporators are M. E., H. C. and K. B. White.

THE ELECTRIC HIGHWAY SIGNAL COMPANY, Boston, Mass., has been incorporated under the State laws to manufacture electrically operated signal devices. The company is capitalized at $10,000. Rishton T. Bailey, Massachusetts Avenue and Tannery Street, Cambridge, is president and treasurer.

THE MARTALEY ELECTRIC CORPORATION, New York, N. Y., has been organized by F. Raab, C. L. Grad and F. Demovitch. The company is capitalized at $20,000 and proposes to manufacture and deal in electrical products. Joseph, Demov & Feinstein, 277 Broadway, represent the company.

THE IDEAL UTILITIES CORPORATION, Homeward, Ill., has been incorporated by Owen D. Kinsey, Willis E. Howes and Lewis U. Heller, Homeward. The company proposes to manufacture electrically operated dish-washing machinery and other equipment for domestic service.

MOONEY, DOUGLAS & PEARSON, INC., New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical equipment. E. I. Cullen, 250 Ninety-third Street, Brooklyn, is one of the incorporators.

THE EMPIRE ELECTRIC GLOBE COMPANY, Brooklyn, N. Y., has been incorporated by S. R. Goldstein, L. Feldman and M. L. Kane, 50 Court Street. The company is capitalized at $100,000 and proposes to manufacture electrical specialties.

THE EAGLE ELECTRICAL SUPPLY COMPANY, Newark, N. J., has been chartered with a capital stock of $20,000 to manufacture electrical specialties. The incorporators are Joseph P. Klesinger and Joseph H. Grabowski, 695 Summit Avenue, Jersey City.

THE ELECTRICAL HIGHWAY COMPANY, Boston, Mass., has been incorporated with a capital stock of $10,000 by Robert U. Merrick, Quincy; Charles B. Putnam, Boston, and William T. Miller, Newton.

THE NORTH STATE POWER COMPANY, RALEIGH, N. C., has been chartered with a capital stock of $250,000 to take over the business of the Cumberland Light & Power Company. The new company proposes to furnish power to individuals and corporations in Cumberland, Bladen, Robeson, Hoke, Harnett, Sampson, Johnston, Wayne, Wilson, Lee, Moore, Wake and other counties. The incorporators are L. H. Crouch, Raleigh; J. B. Johnson, Cardenas; J. W. Blalock, Willow Springs, and others.

THE INSTANTANEOUS ELECTRIC WATER HEATER CORPORATION, Brooklyn, N. Y., has been incorporated by L. Feinman, M. Holland and Samuel Rubinton, 32 Court Street, to manufacture electric water heaters and parts.

THE RADIO SERVICE LABORATORIES, INC., Asbury Park, N. J., has been incorporated by Harold M. Lewis, Hobart A. Simpson and Melvin S. Moore. The company is capitalized at $50,000 to manufacture wireless and other electrical equipment. Joseph M. Turner, 701 Mattison Avenue, represents the company.

Record of Electrical Patents

Notes on United States Patents

(Issued August 16, 1921)

1,387,705. ELECTROLYTIC DIAPHRAGM; William E. Greenawalt, Denver, Col. App. filed May 25, 1920. Unaffected either by the electric current or by the electrolyte.

1,387,736. RADIO-SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed March 8, 1920. Pertains particularly to the disposition of the radio conductor or conductors.

1,387,741. ELECTRIC GENERATING SYSTEM; Chester F. Strong, New York, N. Y. App. filed March 31, 1920. Mechanism for changing the speed of the engine and changing the generator characteristics to maintain voltage on the line substantially equal to that of the storage battery.

1,387,742. ELECTRIC GENERATING SYSTEM; Chester F. Strong, New York, N. Y. App. filed March 31, 1920. Speed of prime mover varied so as to maintain voltage on line substantially equal to that of a secondary battery connected therewith.

1,387,785. HAIR CURLER; Elin M. Lindberg, Duluth, Minn. App. filed April 2, 1921. Applied to the head in its entirety.

1,387,814. WALL PLUG; Abraham Ten Bosch, The Hague, Netherlands. App. filed Oct. 25, 1920. Pins made of two separate halves which by means of a socket are fixed together at the foot.

1,387,819. ELECTRIC WATER HEATER; Arthur M. Werner, San Jacinto, Cal. App. filed Sept. 23, 1920. Provides for withdrawl of water as soon as it is heated.

1,387,848. INTERNAL-COMBUSTION-ENGINE POWER PLANT; John Good, Brooklyn, N. Y. App. filed Aug. 30, 1916. Application of heat to internal-combustion engine working on the relatively non-volatile fuels such as kerosene.

1,387,850. SYSTEM OF RADIO-DIRECTIVE CONTROL; John Hays Hammond, Jr., Gloucester, Mass. App. filed June 7, 1921. Apparatus by which a movable body is made to move or to face in the direction of a source of radiant energy.

1,387,879. MAGNETIC PULLEY; John P. Bethke and Roswell H. Stearns, Milwaukee, Wis. App. filed Jan. 22, 1920. Having a high rate of cooling or radiation and a high flux density.

1,387,885. RADIO-SIGNALING APPARATUS; William R. Davis, Minneapolis, Minn. App. filed March 9, 1918. For classroom work.

1,387,897. SLIDING TROLLEY; Otto Moore, Frankfort, Ind. App. filed April 26, 1920. Means for prolonging the life of such devices.

1,387,907. MINIATURE LAMP-SOCKET FOR CHRISTMAS TREES; Adolph C. Recker, Oakville, Conn. App. filed Dec. 12, 1919. Reduces the cost of manufacturing.

1,387,928. DRY-CELL CAN; Homer W. Jones, Cleveland, Ohio. App. filed Dec. 22, 1910. Manufactured without the use of a soldered side seam.

1,387,945. ADAPTER FOR TELEPHONE CALLING DEVICES; Harry W. Pugh, New York, N. Y. App. filed Nov. 11, 1919. Calling device and a telephone transmitter fitted into a self-contained unit.

1,387,984. NEGATIVE RESISTANCE; Albert W. Hull, Schenectady, N. Y. App. filed Aug. 30, 1915. Device in which the current will decrease as the potential applied thereto increases.

1,387,985. ELECTRON-DISCHARGE DEVICE; Albert W. Hull, Schenectady, N. Y. App. filed Nov. 13, 1916. Particularly devices suitable for use as relays for amplifying variable currents.

1,387,986. WIRELESS RECEIVING SYSTEM; Albert W. Hull, Schenectady, N. Y. App. filed March 10, 1917. For producing a high degree of amplification of feeble currents produced by received signals.

1,387,990. CONTROL SYSTEM; Harold L. Keith, Wilkinsburg, Pa. App. filed Dec. 17, 1919. For motors subjected to quick reversals of their direction of operation.

1,388,086. PROCESS FOR RECOVERING VALUES FROM ORES; Edgar A. Ashcroft, London, England. App. filed Sept. 15, 1920. Process consists in converting the metal constituents of the ore into chlorids.

1,388,088. ELECTRIC THIRD RAIL; Arne K. H. Bjorge, St. Paul, Minn. App. filed Dec. 17, 1919. Third-rail structure affording a maximum degree of safety.

1,388,111. ELECTRIC STOVE; Allan G. Harrington, Chicago, Ill. App. filed May 28, 1920. Generates heat under finer degree of control than is usually the case.

1,388,112. METHOD OF AND APPARATUS FOR TREATING AIR AND GASES ELECTRICALLY; William T. Hoofnagle, Bloomfield, N. J. App. filed March 6, 1920. Treatment of the air in the production of nitrogen oxides.

1,388,116. HEATING UTENSIL; George S. Monson, St. Paul, Minn. App. filed July 31, 1920. Utensils employed in dental offices.

(Issued August 23, 1921)

1,388,167. SYNCHRONIZING-CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Dec. 30, 1920. To control operation of secondary clocks.

1,388,216. ELECTROLYTIC CELL; Charles J. Thatcher, New York, N. Y. App. filed Oct. 21, 1919. For operations on commercial scale.

1,388,217. INSULATOR; Cyril H. Thomas, Chicago, Ill. App. filed May 9, 1919. Stable union between insulator and support.

1,388,270. ELECTRIC HEATER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed May 31, 1918. For chafing dishes, toasting, broiling, etc.

1,388,287. DEVICE FOR PREVENTING WRECKING OF CROSS-WIRES OF TROLLEY SYSTEMS; William F. Murray, Minneapolis, Minn. App. filed April 1, 1921. Shield readily attached to trolley pole.

1,388,336. UNDERGROUND AND SUBMARINE ANTENNA; Earl C. Hanson, Washington, D. C. App. filed Feb. 25, 1919. For reception of radio signals.

1,388,337. ELECTROPLATING APPARATUS; Forest H. Hartzell, Dayton, Ohio. App. filed April 22, 1919. Rotary-barrel type.

1,388,368. CALLING DEVICE; Alfred T. Palmer, Medford, Mass. App. filed March 20, 1919. Automatic telephone system.

1,388,369. SIGNALING DEVICE; Alfred T. Palmer, Medford, Mass. App. filed Feb. 16, 1920. Calling mechanism within base of standard telephone desk set.

1,388,373. HIGH-RESISTANCE UNIT; Floyd K. Richtmyer, Ithaca, N. Y. App. filed Feb. 6, 1919. Of comparatively permanent value.

1,388,402. APPARATUS FOR SINGEING THE HAIR; Isidoro Calvete, London, England. App. filed Jan. 19, 1920. Electric resistance coil to supply the heat.

1,388,420. AMUSEMENT DEVICE; John Flinner, Leavenworth, Kan. App. filed Aug. 5, 1918. Wheel which is apparently self-propelling.

1,388,434. METHOD AND APPARATUS FOR BUTT-WELDING THIN-GAGE TUBING; Gustave V. Johnston, Chicago, Ill. App. filed June 9, 1919. High-speed production of thin-walled tubing.

1,388,441. MULTIPLE ANTENNA FOR ELECTRICAL WAVE TRANSMISSION; Michael I. Pupin, Norfolk, Conn. App. filed Oct. 1, 1915. Screening against disturbance.

1,388,448. ELECTRIC PRODUCTION OF AMMONIA; Henry Blumenberg, Jr., Oro Grande, Cal. App. filed May 12, 1919. High temperatures avoided.

1,388,449. STARTING AND SPEED-CONTROLLING DEVICE; Ernest J. Brasseur, Chicago, Ill. App. filed June 12, 1920. For starting, stopping and varying speed of shafts.

1,388,450. TRANSMISSION OF INTELLIGENCE; E. H. Colpitts, East Orange, N. J. App. filed Sept. 3, 1915. Sustained oscillations of high frequency employed as carrier waves.

1,388,458. SECONDARY ELECTRIC CLOCK; Frederick Frick, Waynesboro, Pa. App. filed Sept. 29, 1920. Silent in operation.

1,388,466. ELECTROLYSIS OF SOLUTIONS AND APPARATUS THEREFOR; Albert H. Hooker, Niagara Falls, N. Y. App. filed Aug. 5, 1920. Decomposition of sodium-chloride solutions.

1,388,474. APPARATUS FOR ELECTROLYZING SOLUTIONS; Thomas L. B. Lyster and Kenneth E. Stuart, Niagara Falls, N. Y. App. filed Aug. 13, 1920. Decomposition of sodium-chloride solutions.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

SKOWHEGAN, ME.—Work is under way by the Central Maine Power Company preliminary to the construction of the North Channel dam at Showhegan for the development of 13,000 hp. W. G. Elliott is superintendent. J. A. Leonard is designing and consulting engineer.

WESTFIELD, MASS.—The plant of the Westfield Power Company was recently damaged by fire, causing a loss of about $20,000.

Middle Atlantic States

ALBANY, N. Y.—Plans are being prepared by the State Superintendent of Public Buildings, Capitol Building, for the installation of additional electrical equipment in the Capitol Building. Lewis P. Pilcher is state architect.

EAST AURORA, N. Y. — The Depew & Lancaster Light, Power & Conduit Company has acquired the properties of the East Aurora Electric Light Company. The new owner is planning to erect an 11,000-volt transmission line from its Gardenville substation direct to East Aurora to transmit Niagara Falls power to surrounding territory, including the township of Holland. The East Aurora plant will be dismantled, and a substation equipped with new transformers and switching apparatus will be erected within the village limits.

LOCKE, N. Y.—The Empire Gas & Electric Company has been granted a franchise to furnish electricity in the village of Locke. Application has been made to the Public Service Commission by the Empire Company to extend its transmission lines to Locke. L. C. Reynolds, Auburn, is superintendent of the company.

CHESTER, N. J.—Arrangements are being made by the Central New Jersey Power Company to develop property at Lake Takeene, near Chester, including the installation of electric lines for light and power service.

NEWARK, N. J.—The installation of a new electrically operated police signal system is under consideration by W. J. Brennan, director of the Department of Public Safety.

NEWTON, N. J.—Permission has been granted to the Newton Electric & Gas Company by the Board of Public Utility Commissioners to issue stock to the amount of $53,000, the proceeds to be used for extensions, improvements, etc.

CARLISLE, PA.—Plans are under way by the street-lighting committee of the Chamber of Commerce for the installation of additional lamps on High and Hanover Streets. Similar installations will be made on other streets in the business district.

DOYLESTOWN, PA.—The Bucks County Electric Company is considering improvements to its plant, including the installation of additional machinery.

FOXBURG, PA. — H. D. Walbridge & Company, Inc., 14 Wall Street, New York City, it is reported, have acquired the Foxburg (Pa.) Inn for the purpose of establishing commissary headquarters and living quarters for engineers and officials to be engaged in the construction of the Clarion River power plant and dam, near Foxburg.

JUNIATA, PA.—The Juniata Public Service Company is planning the installation of lighting systems in a number of towns in this section. Application has been made to the Public Service Commission for permission to enter into contracts with the various boroughs for the service.

PHILADELPHIA, PA. — Improvements and extensions are under consideration by the Franklin Sugar Refining Company, 125 South Orianna Street, to its power house at Teed and Meadow Streets, to cost about $20,000.

PHILADELPHIA, PA.—A portion of the works of the Atlantic Refining Company, Passyunk Avenue, including four large elec-

trically operated pumping plants, was recently damaged by fire. The loss, with machinery, is estimated at about $1,000,000.

PITTSBURGH, PA.—The Bellevue power house of the Duquesne Light Company, it is reported, has been damaged by fire. The loss is estimated at $20,000.

BALTIMORE, MD.—Surveys of the Susquehanna River from Harrisburg, Pa., to Port Deposit, Md., ordered by Congress, are being made by the United States Engineer's office for hydro-electric and navigation developments. The construction of five dams for impounding water for electric power service and five generating stations is provided for in the present plans. The project, including electric transmission and distributing lines, is estimated to cost $100,000,000. Major Harrington, United States Engineer's office, Baltimore, is in charge.

BALTIMORE, MD. — Plans are under consideration by the board of directors of the University of Maryland for the construction of a new power house in connection with the erection of proposed new buildings at Greene and Lombard Streets, estimated to cost about $1,250,000.

CHELYAN, W. VA.—The Chelyan Electric, Water & Ice Company plans to expend $7,000 to erect a transmission line a distance of about 3 miles. The company also contemplates establishing an ice plant soon. Ernest E. Coon is secretary and treasurer; B. M. Green, Charleston, is consulting engineer.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for furnishing the following: Until Sept. 30, Mare Island, Schedule 8,733—miscellaneous quantity of electric wire and cable. Until Sept. 27, Mare Island, Schedule 8,737—miscellaneous quantity of lamp cord and electric wire.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will make improvements to the power plant and fire protection system at the navy yard at Lake Denmark, N. J. Applications accompanied by a deposit of $10 may now be filed for plans and specifications (4501), and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the chief of the Bureau of Yards and Docks.

North Central States

GRAND RAPIDS, MICH.—The Marquette Lumber Company, 1555 Taylor Street, N. W., is having plans prepared for the construction of a two-story power house.

LANSING, MICH. — Preliminary plans have been prepared for the construction of a municipal electric light and power plant on the Grand River below the dam near Moore's Park, to cost about $1,650,000. Woodwell & Resler, 501 Fifth Avenue, New York City, are engineers.

EAST LIVERPOOL, OHIO. — The Ohio Power Company contemplates improvements to its property in the East Liverpool district, to cost about $37,000. The present plans provide for rebuilding the 13,000-volt line from the Wellsville substation to Boring's Crossing, to cost about $10,000, and repairing the line from Boring's Crossing to Empire, to cost about $7,000. H. G. Sterling is manager.

HAZARD, KY.—The Hazard Power Company has filed notice of increase in capital stock from $50,000 to $100,000, and plans immediate improvements. New machinery and equipment will be purchased, for which bids, it is understood, are being received.

SIMPSONVILLE, KY. — The Simpsonville Lighting Company, recently incorporated with a capital of $30,000, contemplates the establishment of an electric light plant. W. P. Thompson and others are incorporators.

STANTON, KY. — The Stanton Power Company, recently organized with a capital stock of $30,000, is planning the establishment of a plant in Stanton and the erection of transmission lines to connect nearby towns.

INDIANAPOLIS, IND.—Bids will be received by the Board of County Commissioners until Sept. 27 for extensions and improvements to the power house at the county jail. C. S. Bark, 159 East Market Street, is architect.

KENDALLVILLE, IND.—The Board of School Trustees have had plans prepared for the construction of its new power house. Improvements will also be made to the plant now in use.

WELDON, ILL.—The village authorities are considering the construction of a new municipal power station, 35 ft. x 50 ft., to be erected on the site of the present plant. The new building will provide sufficient space for a two-unit plant.

MADISON, WIS.—Bids will be received at the University of Wisconsin until Sept. 26 for the construction of an electric substation and a one-story addition to service building. The cost is estimated at $55,000. A. Peabody, Capitol, is state architect.

PORTAGE, WIS. — The Portage Co-operative Canning Company, Michel Building, is considering the construction of a cannery to cost about $275,000. The plans provide for a three-story main building, two-story power house, warehouse and a one-story office building.

SHEBOYGAN, WIS.—Bids are being received, it is understood, by the East Wisconsin Electric Company for the construction of a generating plant, 60 ft. x 210 ft., on Main Street. A transmission line will also be erected from Sheboygan to Fond du Lac. The total cost is estimated at $350,000. H. Ellis, Eighth and Pennsylvania Avenue, is vice-president.

ST. CHARLES, MO.—Benham & Mullergren, consulting engineers, Firestone Building, Kansas City, has been engaged by the Council to prepare plans for the construction of a municipal electric power plant, to cost about $200,000. Otto Beokemeir is city clerk.

BLUFF CITY, KAN.—Plans are being prepared for the erection of a transmission line from Bluff City to Anthony, to cost about $25,000. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

QUINTER, KAN.—The City Council is considering calling an election to submit to the voters the proposal to issue $45,000 in bonds for an addition to the power plant. The Ruckel Engineering Company, Hutchinson, is engineer.

Southern States

KINSTON, N. C.—Improvements to the municipal electric light plant, including the erection of a 200-ft. smokestack, to cost about $300,000, are under consideration.

CHESTERFIELD, S. C.—Plans are under consideration by the Teal Light & Power Company for the construction of a new power plant.

DILLON, S. C.—The Town Council and the Commissioners of Public Works of Dillon request manufacturers and dealers in semi-Diesel type oil-engines, generators, exciters and switchboards to quote prices on two 200-hp. units and alternate prices on one 200-hp. unit and one 300-hp. unit. Further information and specifications may be obtained from the Ryan Engineering Company, Arcade Building, Columbia, upon a deposit of $10. Specifications are also on file at the office of the city clerk, Dillon. L. C. Braddy, Jr., is chairman of the Commission of Public Works.

SPRINGFIELD, GA.—The City Council is considering the construction of a municipal electric light and power plant. The machinery is estimated to cost about $25,000.

LEPANTO, ARK. — The installation of electric light, sewer and water systems in Lepanto is under consideration. R. C. Finn is town recorder.

CRESCENT, OKLA. — Plans are under way for the construction of a transmission line from Crescent to Guthrie, to cost about $25,000. A. B. Powell is city clerk. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

KETCHUM, OKLA.—A plan to construct a dam across Grand River near Ketchum in Mayes County is being revived. The project is being promoted by Byron Kirkpatrick and Charles Page of Tulsa, and W. B. Collins of Ketchum, organizers of a $20,000,000 corporation for which a charter has been granted.

KINGSTON, OKLA. — Plans are under consideration by the Kingston Ice & Light Company for rebuilding a portion of its plant recently destroyed by fire. The loss is estimated at about $25,000.

PRYOR, OKLA. — Bids are being received, it is reported by V. V. Long & Company, engineers, Colcord Building, Oklahoma City, for the erection of an 8-mile transmission line to Pryor Creek.

KYLE, TEX.—The power house of the Kyle Light & Power Company was recently destroyed by fire. The plant, it is understood, will be rebuilt.

Pacific and Mountain States

BUENA VISTA, CAL.—G. S. Eyre and associates are considering the erection of a hydro-electric generating plant on Chalk Creek.

DIXON, CAL.—The Pacific Gas & Electric Company contemplates the construction of a main electric substation in Dixon for the purpose of uniting the line running through the hills to the west and the new line from Pit River.

FRESNO, CAL.—Plans are under way by the Department of Public Works for the installation of a fire-alarm system to cost about $175,000. The system will include a central fire-alarm station and an underground cable system for the commercial districts of the city.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has taken out a permit for rebuilding the old central substation at 1137-47 O Street, recently damaged by fire. The new structure will cost about $13,500.

LOS ANGELES, CAL. — The Board of Public Service Commissioners has requested E. F. Scattergood, chief electrical engineer of the bureau of power and light, to present plans and specifications for the construction of the San Fernando power plant and pipe lines. The new plant will be built near the San Fernando Boulevard at the foot of the cascades, a short distance this side of the Newhall tunnel, and will add 8,000 hp. capacity to the city's system. The cost of the plant is estimated at about $83,000.

MARE ISLAND, CAL.—An appropriation of $150,000 has been made for improvements to the central power plant at the Mare Island Navy Yard. The plans provide for the installation of a 500-kva. Allis-Chalmers turbo-alternator, etc.

OROVILLE, CAL. — The Hutchinson Lumber Company has awarded contract to the Great Western Power Company for furnishing power for its forest and mill operations. A transmission line will be erected.

RIVERSIDE, CAL.—The Southern Sierras Power Company is contemplating the construction of a 3,000-hp. plant in Mill Creek Canyon near Forest Home, to cost about $500,000. Application has been made for appropriation of 12.50 sec.-ft. of water from Falls Creek, which is a tributary of Mill Creek.

SACRAMENTO, CAL.—Preliminary estimates for the construction of a municipal power plant for Sacramento place the cost at approximately $8,000,000. A bond issue is proposed. A power-plant site in the vicinity of Folsam has already been secured.

SAN BERNARDINO, CAL.—Properties of the Arrowhead Reservoir & Power Company in the San Bernardino Mountains and along the Mojave River have been transferred to the Title Insurance & Trust Company of Los Angeles, to be held in trust for a syndicate of Los Angeles capitalists headed by Morgan Adams. The plans of the syndicate provide for the completion of a power and irrigation project in connection with Little Bear Lake dam, which was included in the transfer. Surveys are under way for raising dam 9 ft. and constructing a spillway.

STOCKMORE, UTAH.—Plans are under way by the Great Basin Power Company, Walker Bank Building, Salt Lake City, for the construction of a hydro-electric generating plant with an initial capacity of 10,000 kw. in the vicinity of Stockmore. H. A. Strauss is engineer.

SHELLY, IDAHO.—The Shelley Light & Power Company has been granted a fifty-year franchise for furnishing electricity for light and power in Shelley.

Canada

CHARING CROSS, ONT.—Plans are under consideration by the authorities of Raleigh Township for the erection of electric lighting and power distribution systems to Louisville and Kent Center and through the southern part of the township, to cost about $60,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.